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Contributions.

MR. FONTAINE'S SMOKE STACK.

The accompanying engraving represents quite clearly the construction of an improved smoke stack which is at the present time in use on a number of passenger locomotives of the Pittsburgh, Fort Wayne & Chicago Railway. Four of these engines ran the Pacific "fast train" over the line during the past season and were highly commended by the engineers as well as the master mechanic of the company.

An inverted cone or deflector with recurving flanges *h h* is placed directly over the pipe and beneath the netting, and a cylinder *f*, with a flange *g g*, is secured by the fastenings *f f* about the pipe *c c* so as to leave an annular opening between the pipe and cylinder. The sparks from the fire box are carried up through the pipe and the cylinder, and, striking the cone, are thrown down the outside of the cylinder upon the converging bottom of the head of the smoke stack, so as to come beneath the opening between the cylinder and the inside pipe, where they are again carried up through the cylinder until, again striking the deflector, they are thrown down in the same manner; this process being repeated until the sparks are extinguished by the steam, and beaten to dust by being carried against the cone; after which the portion not consumed is finally carried off through the bonnet.

The results of their working on the Fort Wayne road have been highly satisfactory, the advantages being cleanliness and good draft and economy in fuel and construction. All the new stacks now made at the Fort Wayne shops are building on this plan.

Mr. W. A. Roberts, at Fort Wayne, Ind., will furnish further information when desired.

THE IMPORTANCE OF LIGHTER ROLLING STOCK.

In reading a late number of the GAZETTE, it was gratifying to observe the increasing interest your journal is acquiring, by the varied intelligence it contains concerning the progress of railroads and the clear exposition of certain improvements which have been recently attempted.

Among these is the double-bogie locomotive of Mr. Fairlie and the *narrow-gauge* so highly extolled by that gentleman.

Your answer to his letter is peculiarly appropriate, because without resenting his impudent assumption of superior knowledge respecting the passage of railroad cars around curves, his ignorance is fully exposed by your practical illustration of the subject.

Mr. Fairlie, however, concedes the superiority of what he terms the single-bogie system, as an approach to his double-bogie ideas.

The narrow-gauge is now exciting considerable attention, and companies are organized for its construction in several parts of this country, as well as in Europe and India. You have, however, already shown how much the advantages derived from it are overrated by Mr. Fairlie.

Admitting, nevertheless, that, in some cases, there may be much economy, both in the construction and operation of a narrow gauge line, a little reflection will show that the true cause of success is the small proportion of dead weight compared with that which we have on ordinary railroads. On account of the magnitude of this evil, were it impracticable to introduce any other remedy, the narrow-gauge with all its defects and inconveniences would be more deserving of attention.

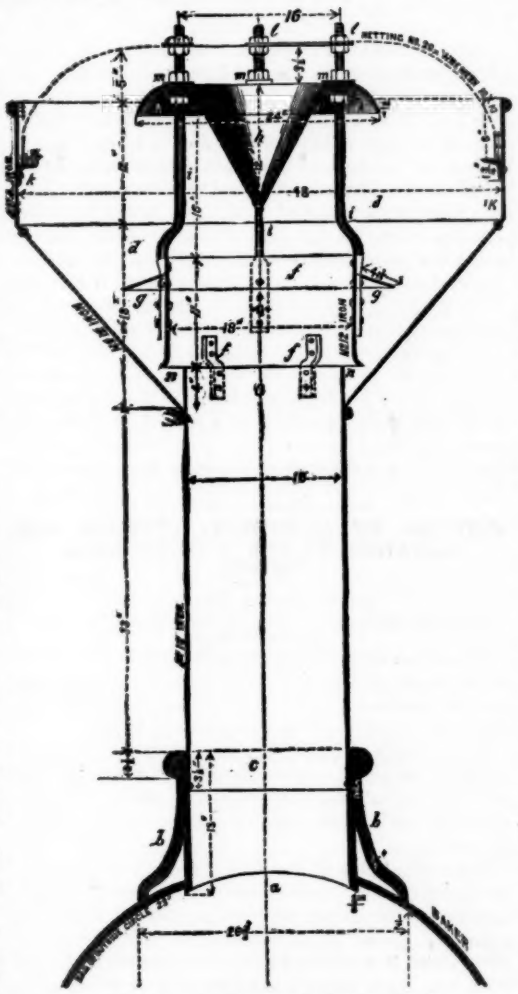
The present system with a 4 ft. 8½ in. gauge and eight-wheeled cars, with trucks or *bogies* at each end, originated from the necessity, in the early days of railroads in the United States, of adapting railroads to existing circumstances, and the small amount of capital that could then be obtained for their construction.

Railroads, at that time, were not ballasted, and the English four wheeled cars were very liable to run off a poor track, while cars with trucks were found to move safely over bad roads, at a fair rate of speed.

The increase of dead weight was not then regarded of material consequnce. Our best engineers supposed that iron T rails would endure 50 or 60 years, at least. As a necessary result, locomotives were increased in weight and the general adoption of heavy rolling stock has followed.

The period, however, has now arrived when the construction and operation of railroads will stand upon their intrinsic merits, and the question concerning the weight of cars and engines has become of primary importance.

The total weight of ordinary box cars varies from 16,000 to 18,000 lbs. On these, a full load is 20,000 lbs., and in that case the dead weight is only 85 per cent. of the paying weight.



Fontaine's Improved Smoke Stack.

But cars are not always fully loaded; half loaded and empty cars *must* be run over a railroad under the best management.

The average load of freight, on the Chicago, Burlington & Quincy Railroad, is one ton of paying weight to 1.49 of dead weight, and this may be considered a favorable average for Western railroads.

In England they dispense with trucks, and their wagons, or cars, can carry one ton and $\frac{65}{100}$ of paying weight for every ton of wood and iron, or 48 per cent. more than our American double-truck cars.

It becomes a question, whether we must adopt a narrow gauge as a remedy.

It is not from the inability or want of ingenuity on the part of our mechanics, that with the common gauge, cars cannot be built 50 per cent. lighter, and as well adapted for all purposes as the heavy double-truck cars. Give them the inducements and the object will be effected. Hitherto railroad companies have had no motives to encourage any improvement of this kind. An enormous amount of capital has been invested in rolling stock, under the present system, and consequently no change will be made, unless competition from narrow-gauge, or better built railroads of the present gauge, should render a change absolutely necessary.

To illustrate the advantages of reducing dead weight suppose the freight transported over a hundred miles of railroad amounted to a hundred thousand tons. According to the reports of the Chicago, Burlington & Quincy Railroad Company, 149,000 tons of dead weight must be run over the track to effect this object. The earnings, at the rates adopted by that company, would be $372,000, and the expenses about one-half, hence the net earnings would be $186,000. Reduce the dead weight 49,000 tons, by making cars of two-thirds of the former weight, and the saving thereby would be $91,000 clear gain.

It may be said that lighter cars would not stand the heavy traffic of the Chicago, Burlington & Quincy Railroad, but the fact is undeniable, that cars proportionably light, are actually in use in England on railroads having twice the traffic of that line.

With regard to passengers, the disproportion between the dead and paying weight is still more remarkable, being, according to the most reliable statements, at least ten to one.

Much of this is owing to the introduction of Pullman's luxurious and ponderous sleeping cars. These probably increase the average proportion of dead weight, one third. Independently of these, therefore, our railroads carry about 700 lbs. of dead weight for each passenger, besides his luggage.

A common street railway car weighs three tons and seats twenty passengers, often carrying fifty. It is the opinion of good mechanics familiar with railroad rolling stock, that cars not exceeding five tons in weight, with ample strength for high velocities, can be built to carry forty passengers comfortably, or with only 250 lbs. dead weight, for each passenger, which is less than one-half the loss in an ordinary passenger car fully loaded.

That the introduction of Mr. Fairlie's double-bogie engines or the construction of narrow gauge railroads would be found extensively useful in practice, requires better proofs than have as yet been laid before the public; but if through the influence the discussion of them is exercising the much needed reform of the present railroad system should be reached, its importance cannot be too highly appreciated. Otherwise, with all their defects and inconveniences the narrow gauge railroads will be able to compete successfully with railroads subject to the enormous loss inseparable from the present unmechanical and unnecessary weight of rolling stock.

R. P. MORGAN.

IRON BRIDGES—SHAPES OF THEIR PARTS.

The tendency of engineers and railroad companies appears to be toward the erection of permanent iron structures on the principal lines of railroad in place of the many wooden bridges and viaducts heretofore so extensively in use in this country.

Are all the iron bridges and viaducts being built in this country really permanent structures? As a railroad man I wish to make some suggestions as to the general getting up of permanent structures of iron.

All bridges and viaducts should be of wrought rather than of cast iron, especially all parts liable to a tensile or cross strain.

All parts under a tensile strain should be of a uniform fibrous iron, while the parts liable to a compressive or mixed strain would be better of a harder granular iron of a fine uniform crystallization.

The structure should be so proportioned that the maximum load should not cause a strain on any part of it to exceed one-fourth of the strain that would produce a set or destroy the permanent elasticity; for a constant application of a strain that will produce a set will break the iron, notwithstanding the iron will show

an ultimate strength in a testing machine of from 20,000 to 30,000 lbs. per square inch more than a strain that would overcome the permanent elasticity and produce set. Therefore strains bearing a certain proportion to the permanent elasticity of the iron should be taken as a factor of safety instead of the ultimate strength, which is too often taken by engineers in the construction of permanent structures of iron. Iron is an elastic material and is subject to changes in dimensions by reason of changes in temperature, and should be so arranged as to accomodate itself in its change of dimensions without subjecting any part of the structure to an undue strain.

In constructing bridges or viaducts, no shape or form of iron should be used that has of itself or will form cells, cavities, or hidden surfaces that cannot be seen and reached with a paint brush at any and all times. Form no hidden surfaces to be acted upon by the moisture of the atmospere. There are made in this country all the required shapes and forms, such as I beams, channel, T and angle-irons, that can be used in various combinations to meet any required strains and form no hidden surfaces.

A bridge or viaduct properly proportioned and built in this way of suitable material and properly protected from moisture by painting I think should be safe for 100 years. Such s structure would be worthy of the name permanent.

There are many structures being built in which such shapes or forms of iron are used as make it impossible ever to paint the inner surfaces or to see or know anything about the working of moisture or the mischief going on inwardly.

We know atmospheric moisture is very destructive to iron, especially where there is no sunlight and very little or no circulation of air. Take a hollow wrought-iron colum 3-16 of an inch thick, which is a sufficient sectional area to meet the maximum strains within the factor of safety usually allowed by engineers in the construction of bridges and viaducts. What engineer will say that, ten or twenty years after erection, such a column would not be reduced and wasted away by rusting on the inner surfaces that cannot be seen or protected? Suppose in ten or twenty years 1-16 of an inch of the thickness is gone by rust, and very likely much more, where then is your factor of safety? The structure would have become dangerous, while one built on the same plan, except in the shapes and forms of iron used, would not have reached middle age.

We are very careful to paint the outer surfaces and use every possible means to protect them from the never-failing effects of the atmosphere; then why should we use shapes and forms of iron in our structures that are of themselves hidden or inner surfaces that cannot be equally protected, when there are so many shapes and forms of iron that give no hidden surfaces to destroy our structures—that possess all the advantages of the objectional ones, and are not subject to any of their serious objections?

With engineers and railroad companies this is a grave subject, and all I wish or expect is to call their attention to the matter, believing that they will give it the consideration to which the subject is entitled. I offer no fine-spun stories, but simple facts from my own personal observations as a practical man.

PRACTICAL.

The St. Louis, Iron Mountain, Little Rock & Galveston Railroad.

ARCADIA, MO., December 24, 1870.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Some months since I sent you an account of the commencement of work on the first twenty-two miles of the Arkansas branch of the St. Louis & Iron Mountain Railroad, from Pilot Knob south. The contractors, Messrs. Mandeville, Allen & Co., have just finished the grading of these twenty-two miles, and are putting down the track, and by the 1st of March, if not sooner, the iron horse will be thundering over the entire length of this piece of new road. The same parties have also just concluded a contract for thirty additional miles of this road, and expect to have it completed within the next six months. I learn that it is the intention of the railroad company to push the line through to Little Rock, Arkansas, as fast as it can be done, the ultimate destination being Galveston, Texas. A considerable force of hands is said to be engaged on the portion of the line between Little Rock and Galveston. The State of Texas has already made a large land grant to the road, and the State of Arkansas will also vote a liberal subsidy in its aid so soon as the Legislature can give the matter its consideration. It is also the intention of the railroad company to build a branch road from some point on the main line to Helena, Ark., thus giving the road two distinct connections with the Southern States. That this will be one of the best paying railroads in the Union there can be no shadow of doubt. Southern Missouri abounds in inexhaustible mountains of iron and mines of lead, copper, tin, nickel, and other valuable minerals, and these, as well as her extensive forests of fine timber, must all find an outlet to market over the St. Louis & Iron Mountain Railroad. The best cotton, grain and live stock portion of Arkansas will also be opened up to market by it, and, when it is completed to Galveston, it will be the most important, as well as most direct, railroad between the Northeast and Southwest. Chicago should feel a deep interest in the construction of this line, for by building a road from Centralia or some other point on the Illinois Central Railroad to Ironton, *via* Ste. Genevieve, it could have a shorter route to the Gulf of Mexico than is attainable by any other route. This road would also enable Chicago to compete successfully for the trade of Southern Missouri and the State of Arkansas. Another important reason why Chicago should build or aid in building the road in question, lies in the fact that a branch must ultimately be built from the St. Louis, Iron Mountain & Galveston road to the Pacific. The counties through which the road passes from Ste. Genevieve to Ironton have already signified their willingness to aid in building the road. Ste. Genevieve county offers $200,000, St. Francis county $100,000, and I learn that the American Iron Mountain Company, which will find a short line by this road over which to ship its ores to the Mississippi, offer to subscribe $250,000. This road being a feeder for the St. Louis & Iron Mountain Railroad, would doubtless receive a warm support from Mr. Allen, its President, and I trust that the business men of Chicago will give the proposed line a hearty support. An effort is also on foot to build a road from the Iron Mountain, or Bismark, on the St. Louis & Iron Mountain Railroad, westward *via* Salem, in Dent county, to connect with the Laclede & Fort Scott Railroad at Lebanon, Mo. One of the main objects of this line is to open up the extensive iron fields of Dent county to market. As the distance to the iron deposits in Dent county by this is less than by the proposed road from St. James, or any other point on the Southwest Pacific Railrond, and the route far more feasible than can possibly be had by the St. James and Southwest Pacific roads, it must receive the hearty support of those who are interested in getting the iron ores of Dent county to market. Chicago is also very greatly interested in this road, as its construction, in connection with the road from Centralia to the Iron Mountain road *via* Ste. Genevieve, would enable your people to run around St. Louis and reach Southwest Missouri, Northwest Arkansas, Southern Kansas and the Cherokee Nation by a short and direct line.

T. B. D.

METHODS OF ALIGNMENT, LEVELING AND LOCATION OF THE CHICAGO LAKE TUNNEL.

BY WILLIAM H. CLARKE.

[Read at the December meeting of the Northwestern Civil Engineers' Club.]

It has been suggested to me as a subject for a paper for this evening, that a short account of the methods pursued for the alignment and leveling of the Chicago Lake Tunnel might not be uninteresting to you.

The pressure of public business has given me very little time to prepare this account, but a few general facts and special observations may be worthy of your attention for a short time. I will first speak of the alignment.

The original plan of the work proposed at least one, or perhaps three, intermediate shafts, which would have greatly facilitated the setting out of the line. The great expense of these shafts with their protecting cribs, which it would be necessary to remove after the work was done, decided the Board to dispense with them and execute the work from the two shafts, on the land and at the extremity. There was built over the land shaft by the contractors, for the purposes of elevating the excavated earth and lowering the materials, a wooden structure, which was of course directly in the way of a forward sight over the centre of the shaft on the proposed line. At about 160 feet behind the shaft a pier of brick, 25 feet high, about four feet in diameter at bottom, tapering to 2½ feet at the top, based upon a solid foundation below the frost, was erected for the support of the transit instrument used for defining the line. Over this a temporary building was built with suitable openings on the line, and on the meridian for polar observations. Doors were made in the sides of the contractors' house over the shaft, through which observations could be made upon the wires suspended on each side of it, and out to the crib. Through the kindness of Messrs. Matson & Hoes, the use of an excellent astronomical transit instrument made by Pike, of New York, of 3½ inch object glass, was obtained, which was powerful enough to define accurately the line upon a large target which was placed upon the crib after it was located. The work, however, made a good deal of progress from the shore end upon an assumed line, which was 68° 29' east of the meridian. After the shore shaft had been sunk to the grade of the tunnel, 69 68-100 feet below the city datum, the tunnel was commenced and was also carried about 50 feet westward of the shaft, furnishing a place where instruments could be used below, directed on the line. The method of transferring the line from the top of the shaft to the bottom by the means of an instrument with a vertical range was considered, but it was determined to adopt the use of plumb-wires. Two very fine brass wires wound up on large reels were placed on the line in the top of the tower over the shaft, and, by repeated observations in calm days, with heavy plumbs suspended in molasses, on each side of the shaft, the line was carried down to the tunnel, as it was supposed, with exactness. But after the work had progressed about three hundred feet, it was found that with the short distance between the wires, which was less than eight feet, the very thickness of the wires produced a variation in the results which rendered a greater distance between them necessary to insure a true alignment. This was accomplished by sinking through a sand-bar near the shore and 280 feet from the shaft, and exactly upon the line, an artesian tube of 6 inches diameter, which was driven down vertically into the crown of the arch. By observations upon a pair of plumb-wires, one of which was at the shaft and the other through this tube, the line was corrected in that part of the work already completed and determined with sufficient accuracy to enable it to be carried forward with confidence. For the first 1,500 feet the large transit was removed to a portable stand in the drift westward of the shaft, but after that the line was produced by means of a field instrument to which a short tripod was adapted, a "goniometer" having two telescopes in the same vertical plane, by Young, of Philadelphia, which gave very good results. An arrangement was made for illuminating the wires by reflection, and the line was fixed upon the point of the flame of pieces of wax candles slid along on boards across the centre of the tunnel. When these were on line small brass hooks were put into blocks of wood countersunk into the crown of the work, so as to suspend a plumb-line exactly in the true line, by which the lights could at any future time be replaced. At every 1,000 feet steel points were fixed in line in the bottom of the work, suitably protected, so that the instrument could be set over it whenever desired. The chief difficulty in carrying forward the observations arose from the foul air, which was but imperfectly removed by the furnace and blower. This at times was so bad that the lights could be seen at but a very short distance. An attempt was made to burn a tape of magnesium to sight upon, but the result was not an improvement. There were some indications of a horizontal refraction of the line of sight passing through an atmosphere varying in density, and in the leveling the vertical refraction was very marked, requiring frequent repetitions of the levels to obtain a correct average. The contracted space where the work had to be done, there being but about 4½ feet of headroom, rendered it tedious and unpleasant.

It was the intention that the line should be perfectly straight from one shaft to the other, but after the crib had been located precisely on the line, a storm arose before it was secured by filling, which carried it to the north about 14 feet, and as it was working in the sea badly, it was not deemed prudent to attempt to rectify it, but it was filled with stone at once, where it was, and this involved an angle in the line of the tunnel, which was turned at one mile from the shore shaft and was a deflection of 0° 9'. The line was started at the crib end in the same manner as before described, an artesian tube being sunk on the exterior of the crib east of the shaft, on the line, and plumbs sunk through it and the shaft, by which a range of about 50 feet was obtained.

Owing to instrumental and other difficulties, it was necessary to range the plumb lines above, in a line with a target on shore, by means of the naked eye.

It was found on the work coming together, that the lines were 7⅓ inches apart.

LEVELS.

In order to start the levels at the lake shafts where the grade of the tunnel was to be 4 feet higher than at the shore shaft for the purpose of pumping it out on the shore end on occasion, it was necessary to obtain a base corresponding to the one on shore to work from Had there been three intermediate cribs, or even one, it might have been possible to throw levels across, but in a distance of two miles, the refraction, which is so varying, might have caused a serious error. Consequently the lake itself was used as a level. A series of

hourly simultaneous observations of the height of the lake were taken for several weeks on shore and at the crib, and by rejecting all windy days, when the water along the shore might be depressed or piled up, the mean level of the lake above the city datum, was acertained, and the same was thereby established, by repeated trials, upon the crib, until the probable error was not over ⅛ of an inch. When the work came together it closed within about 3 inches, which was chiefly due to error in the workmen.

LOCATION.

The position of the centre of the lake shaft was to have been precisely two miles from the centre of the shore shaft, but the storm before referred to moved it 7 feet eastward, as well as 13 feet to the north of the line. Two base lines were very carefully measured by Mr. R. Potts, Assistant Engineer, one of which ran along the north shore and terminated 4,340 feet from the tunnel, in the vicinity of the old cemetery. The other was measured along the shore southward to the north pier, 3,532 feet, and thence to a signal station eastwardly on the end of the pier, and the other side of the triangle, from the shaft to the end of the pier, 3,802 feet in length, was used for a second base of verification. At the extremity of these bases triangular signals were erected, painted red and white on each side of a vertical line, and by these and other objects the crib was easily brought into position. The measurement of these base lines was made with steel chains with a dynameter attached, which were drawn to a certain tension across the tops of stakes set to a uniform level. On the repetition of the measurements it was found that the pins came into the same holes made in the tops of the stakes by the previous ones. The triangles which were obtained from these bases for the calculation of the distance for the location of the lake shaft were not very well conditioned, the angles at the crib being only about 20 degrees; but notwithstanding, the distance as measured very carefully inside the tunnel agreed with the calculated distance within about four inches. The calculations for the triangulation were made by the late Captain John Reid, the Assistant Engineer.

It is not necessary to say anything with regard to the construction of the work, as that is fully set forth in the eighth annual report of the City Engineer.

Boilers and Boiler Material.

The following is the report of the Committee on Boilers and Boiler Material, of the American Railway Master Mechanics' Association, read at the last annual meeting:

Your committee re-appointed to continue the investigation of the material for and construction of locomotive boilers, have changed since last year, to some extent, the form of the questions contained in circulars addressed to the members of the Association, hoping thereby to obtain additional information, and of a character more general and comprehensive than that embodied in our first report.

It would seem, however, that the nature of the investigation is of so direct a character, and the field of study so bounded by certain well known principles, that in whatever channel we seek for information, the facts evolved would seem to indicate but little of novelty or originality.

The inteligence and enterprise of the American mechanical engineer is so conceded, that none will attribute his conservatism in locomotive construction to a desire of following old designs or methods for want of new ones, but is, perhaps, more the result of careful pains-taking examination of the different theories or so-called improvements which, from time to time, have presented themselves to him, and have proven impracticable, or at least to so great an extent, that although the American locomotive of to-day would seem to be lacking but little of absolute perfection, yet, in the general detail of its construction there is but slight radical change from the engine of ten years ago.

The opinion in some circles has gained a certain degree of credence, that the officers having charge of the department of railway motive power, are favorably inclined to changes or modifications of existing systems of mechanical construction, such changes of course involving additional expenditure in the operation of their departments, and not always producing the practical benefits claimed to arise from such alterations.

Your committee, however, are of the opinion that these views are not well founded; on the contrary, that the railway experience of the past twenty pears, tends to show that the real improvements in use at the present day, have been subject to the most rigid and critical investigation, extending in some instances through a term of years before being reported upon favorably, and their adoption recommended. Hence, to the first question in circular, viz:

"Can you suggest, from experience, any change or modification in the present system of constructing locomotive boilers, in size, space between, or length of tubes, by which better results in evaporation can be obtained in wood and coal burning locomotives?"

They were not surprised to find in almost every instance, answers returned in the negative, the few exceptional cases assuming the form of suggestions or theories, and not direct statements of facts evolved by ezperience.

There is, however, in these suggestions, a harmony of thought which would seem to indicate a necessity for the improvements mentioned, these being confined almost entirely to the construction of furnaces and tubular surface, looking to better results in evaporation, and also to some system which shall combine a greater economy of fuel upon coal burning engines, with a consumption of smoke and gases that in many instances escape, to the annoyance and discomfort of the traveling public.

A prominent exception, however, to these latter suggestions, is contained in a communication from Mr. James M. Boon, Western Division, Pittsburgh, Fort Wayne & Chicago Railway, who directs the attention of your committee to the method adopted by him for the construction of boiler shells.

He uses two sheets in shell of boiler, each five feet wide, making one longitudinal seam in each, this seam double-riveted and located above the water line, thus having but two circular rows of rivets in shell of boiler that are exposed to the action of the water. He fastens neither braces nor fixtures to the bottom of the shell, and uses but two braces, which are riveted to boiler above the centre line.

Mr. Boon states that he finds that the heaviest repairs connected with the shell of boiler are caused by grooving at the seams, and around rivet heads, and that none of this occurs above the water line; hence his object in having as few seams and rivets as possible in direct contact with the water.

As, however, this subject will doubtless be reported upon by the Committee upon Construction of Locomotive Furnaces, your committee prefer not to trench upon their field of duties.

They are, however, thoroughly convinced of the importance of an able and elaborate examination of the principles involved in the economical consumption of fuel upon locomotive engines, and especially those burning bituminous coal, which bids fair, with a few exceptions, to become the standard fuel for the coming time.

In our report of last year, attention was called to the amount of heat escaping through the flues, and it was hoped that some system might be suggested for utilizing the same. But while some experiments have been and are being made, in this direction, there are none as yet which we can confidently recommend as a solution of this vexed problem.

It is hoped that the committee to whom was referred the subject of material for flues, may be able to furnish valuable information upon this subject, which, with the discussions upon this and kindred topics, may furnish data that will serve as a guide for successful experiments in this direction.

As regards the general construction of the locomotive, such as distribution of weight to produce the best traction results, relative proportion of cylinders and boiler, area of valve ports, travel of valves, etc., etc., no suggestions or alterations have been made, and perhaps none are desired; for, in its general adaptation to our railway service, the American locomotive has no peer for efficiency, performing its work in many instances upon road beds notoriously poor, it became a matter of imperative necessity that the engine should not only be *good*, but *remarkably good*, to accomplish even minimum of successful service.

Much has been written and said of the superiority of the English locomotive, but experience has proved, that when removed from the almost perfect road bed, for which the United Kingdom is so justly celebrated, they have failed to compete successfully with the locomotive that stands to-day a proud monument of the skill and enterprise of the American mechanical engineer.

An eminent engineer of this country in reporting upon a series of competitive trials of American and English locomotives made upon railroads of South America, in instituting a comparison of their relative construction, mentions the English engine as a *sturdy, unyielding* mass of machinery standing upon *four* legs, and necessarily requiring a perfect plane to provide a bearing for the points of traction, and the American engine, as standing upon *three* legs, and thus readily accommodating itself to the many inequalities of the superstructure of new roads.

Notwithstanding, however, its general excellence, there is, as we have already stated, a large field for improvement in the consumption of fuel. While in some few instances we have reports of engines burning bituminous coal, and evaporating from seven to nine pounds of water with one pound of coal, yet it is more than probable that in a majority of instances, the results of evaporation will not exceed four to five pounds of water, and some even less.

It would seem that to increase the number and length of flues would materially assist evaporation, and to enlarge the space between flues, thus allowing a more perfect circulation of water, would also aid evaporation. But these changes hardly seem practicable, as they imply an increased diameter and length of boiler and additional weight of engine. As our endeavors all tend to the reduction of the dead weight of our rolling stock, neither of these plans would seem in harmony, or desirable for the ordinary build of locomotives.

Your committee beg leave to urge most earnestly upon the members of our Association the importance of taking up this matter at our forthcoming convention, and examine it exhaustively, as it would seem that no other subject for investigation would achieve more valuable results.

Our second interrogatory, viz.:

"What in your opinion should be the relative area between the grate surface and area of tubes, to obtain the greatest economy in fuel?" has given rise to a variety of opinions. Those from parties using wood exclusively as fuel, vary but little, the majority of these reporting from fifty to fifty-five feet of tube surface to one foot of grate surface.

In engines burning bituminous coal, it is almost impossible to fix upon a ratio between grate and flue area, that shall establish a standard of construction for different qualities of coal.

The English authorities upon this subject, such as Tredgold and Williams, base their results upon experiments made with fuel in which there is hardly a variation from some certain specific gravity. But in this country, and especially throughout the West, there is a vast range in the different qualities of bituminous coal, embracing almost every grade of specific gravity from *lignite* to *slate*.

While we may give as a rule the flue area, such as to furnish the greatest heating surface, with proper circulation of water inside a certain diameter of boiler, the grate area, on the contrary depends upon an entirely different consideration, viz.: the nature of the fuel. Hence the proper grate surface for any particular kind of coal, must be found bv experiment, although it may be taken as a rule, that light specific gravity, free burning coal requires a large grate, and *vice versa*.

Careful observation of the use under different circumstances, will readily establish the area best adapted to the economical consumption of the various qualities of bituminous coal.

On the Illinois Central Railroad, the coal brought from Danville and La Salle mines produces the best results when burned in a grate covering nearly the entire furnace bottom, while on the same road, the Du Quoin coal produces equally favorable results when consumed on a small grate surface in the middle of the furnace—say 18x36 inches.

On the Des Moines Valley Railroad, Mr. Sellers reports satisfactory operations with the same grate area formerly used for burning wood, less the area of ordinary dead plate.

It would be well, perhaps, in the discussions attendant upon this and kindred reports, to touch upon the various results achieved by burning coal at different depths upon the grate, as some engineers run with a light fire, almost exposing the grate, while others carry from twelve to eighteen inches of coal. Each may be right, or each wrong, a matter which investigation will decide.

These subjects your committee hope to hear thoroughly discussed, thereby affording many members who have failed to find time to respond to our circular of inquiry, an opportunity to furnish verbally, extracts from their experience and observation, and from these combined views we shall be enabled to furnish data applicable to our entire range of territory, and embracing every quality of fuel now in use on American railways.

Our third interrogatory, viz.:

"Has your experience during the past year, or since the publication of our last report, suggested any change of opinion in regard to the general use of steel plates for locomotive furnaces, crown and flue sheets?" embraces principally the same field of inquiry upon which we reported at our last annual convention.

The reports, however, for this year, cover a more extended field of territory, and while in our last report the views in favor of the use of steel plates for locomotive boilers were confined almost exclusively to those roads using coal for fuel, in our present report we are happy to find our opinions fully sustained in the past, and we quote this year extensively from parties whose experience is confined to wood-burning locomotives, and all unanimous in the decided superiority of homogeneous steel plate as a standard material for the construction of locomotive furnaces.

The importance of this material and its value in connection with the construction of railway motive power can hardly be over-estimated, and as the successful result of careful experimental investigation, it already occupies a prominent position, which is constantly increasing, among the real tangible improvements of the present age.

It is a well known fact that the heaviest item of expenditure in the maintenance of railway motive power is involved in pay rolls or labor sheets, and hence it is self evident that it is true economy to select none but the best material, such as wil require the least possible labor of experts to keep it in running order, and herein do the homogeneous steel plates manifest their decided superiority over all the other material for the purposes specified, as instances are reported from authentic sources, of fire boxes constructed of this material, running from nine to ten years without labor or expense for repairs, and seemingly to-day in as perfect condition and as little affected by the destructive influences of fire and water as when first placed in service.

While in contradistinction we find that the facts set forth in our last report concerning the comparatively short life, in many instances, of copper and iron sheets, fully corroborated by the additional experience of the past twelve months. The perfectly homogeneous character of these steel plates, and the exreme watchfulness which is manifested at each stage of their manufacture assures us of a perfect degree of uniformity under all circumstances, and thus the constructing engineer is not liable to the mortification consequent upon the discovery of a defective sheet, perhaps but a few days after an engine may have been thoroughly re-fitted.

A fruitful source of failure of iron sheets may be attributed to blistering, and this objection under the present system of manufacture, can hardly be avoided. Even the Low Moor iron is not entirely free from this fault. Of course the majority of the best iron plates will furnish a good degree of service without this objection being manifested; but as, in some instances, failures have occurred, from this and kindred sources, so may we reasonably anticipate their occurrence, and seeking for material which shall assure to us positive immunity against these failures, we find nothing so certain as the homogeneous steel plate.

We find upon continuing, this year, our investigations at the steel plate manufactories, that they are fully aware of the importance of so constructing this material as to guarantee entire freedom from failure of any

character. The only objection that has been or could be urged against the use of steel boiler plates, has been their occasional liability to crack. The precautions that are now taken, and the trial test to which plates are submitted before leaving the manufactory, renders it almost a matter of impossibility for a defective plate to find its way to the consumer.

Nearly all the steel boiler plates now in use upon American railways, are manufactured from crucible cast steel, but your committee have been informed that experiments have been and are being made in the manufacture of these plates by the Bessemer process. Of the success of these latter experiments it would be impossible at present to speak, as the plates, after being successfully cast and rolled, would require the test of at least two or three years service in order to rank with the material produced by the leading American manufacturers, whose plates have been in active service for the last eight years. These experiments, however, are valuable, as tending to show that, as the demand for this material becomes more and more general, the manufacturers, in lieu of endeavoring to create a monopoly, would seem to be striving to supply this demand at as low a rate as is consistent with the furnishing of a strictly first class material. It is believed, however, that even at the present prices, when we consider the increased durability, and the fact that lighter, thinner plates may be used with the same degree of tensile strength, this material is much cheaper than iron or copper, for furnaces and flue sheets, and probably for boilers and coal burning engines.

From an eminent French mechanical engineer, we have a report dated at Paris, March 1, 1870, giving facts and figures in relation to the use of homogeneous steel plates for locomotive boilers, taken from the Oldenburg Royal Railway, Westphalia, Austrian Imperial Railway, Swiss North Eastern Railway, Hessian Sudeng Railway, and Lower Silesian Railway, from which we quote as follows, viz. :

"Oldenburg Royal Railway reports eighteen locomotives, nine of which were ordered eighteen months after having had a first lot of nine in use. The results obtained were entirely satisfactory, and an additional number are now ordered. Our boilers are about forty-nine inches inside diameter, the thickness of the plates of the first lot was 8 m-m," (about 5-16 of an inch); "of the second lot and those now building, 9 m-m," (about 11-32 of an inch.)

"The plates for the first lot were made at John Brown's, Sheffield. Those of second lot are Westphalia steel.

"The smoke-box, outside fire-box, and top plate of the latter, with which the top of the inner fire-box is stayed, by means of steel plates, are respectively 12 m-m, 11 m-m and 10 m-m," (or about 47-100, 43-100 and 39-100 inches.)

"The steel of the plates must be of a quality which will harden. That of the rivets, a quality that will *not* harden.

"We find the Sheffield steel superior to the Westphalia, and that steel boilers rust much less than iron. This fact has also been observed on Austrian railways. We are therefore decidedly in favor of steel.

"Our boilers work at 150 pounds pressure, and we have one [] m. grate surface to 79 [] m. heating surface (or about 39⅓ to 3,108 inches.)

"Weight of engine, empty, twenty-one tons. Have used steel plates for the last three years.

"Austrian Imperial Railway have steel boilers of 110 c-m diameter (about 43¼ inches), and 8 m-m (about 5-16 inch) plates, in successful use for more than ten years.

"Swiss Northeastern Railway test their boilers at twenty atmospheres (about 300 pounds), and work at a pressure of about twelve atmospheres.

"Hessian Sudeng Railway has used steel boilers for three years. Diameter of boiler, 1,242 m-m (about 48 9-10 inches). Thickness of plates, 9 m-m (about 11-32 of an inch). Testing pressure twenty atmospheres. Working pressure, ten atmospheres.

"Lower Silesian Railway Company make their steel boilers of the same thickness of plate as the iron, viz. : Ten or 12 m-m (or 39-100 to 47-100 of an inch), and claim that they thus obtain double strength without augmenting the weight of the engine.

"In conclusion, we deduce from these reports, that all steel locomotive boilers on Continental railways are made now of thicker plates than at first, none of less than 9 m-m, mostly 10 m-m.

"All steel boilers have rivets of soft steel, which does not harden. Diameter of rivets, 25 m-m (or about 98-100 of an inch). Distance between rivets, 100 to 105 m-m (or nearly four inches). Fire-box plates 10 to 11 m-m. Rivet holes drilled, *not* punched. Plates are shaped with planing machine; shears are never used for cutting the same. The demand for steel locomotive boilers is rapidly increasing."

Your committee beg leave to express their obligations to the gentlemen who have kindly favored them with suggestions and information, and with the hope that the views they have expressed may produce a general discussion upon the important subjects herein involved, their report is respectfully submitted.

S. J. HAYES,
Superintendent of Motive Power, Illinois Central Railroad.
C. F. JAURIET,
Superintendent of Motive Power, Chi., Bur. & Quincy Railroad.
H. ANDERSON,
General Master Mechanic Northwestern Railway.

After the reading of the report, the following discussion was had :

Mr. Hays, I. C. R. R.—It appears, sir, that some have misconstrued the report, as read. The closing part of that report is simply a quotation from a French engineer, and we have merely taken his words. Where the rivets are four inches apart, it means on a straight line; but as the rivets are put in zig-zag, they will not lie over two inches apart. I hope the correction will be made relative to this matter, in order that it will make no erroneous impression on the public.

Mr. Sellers, D. M. V. R. R.—I mean so ask Mr. Hayes if he means four inches from center to center, on the line of rivets nearest the lap?

Mr. Hayes—Yes.

Mr. Sellers—What is the thickness of the plate?

Mr. Dodge—It is from 39 to 47-100th of an inch—a little less than half an inch.

Mr. Sellers—It seems to me quite an impossible manner to make the joint of that width perfectly tight, if I understand the position of these rivets. I find it impossible to make a boiler tight with two and a half inches from center to center. The same committee last year recommended three-fourths inches from center to center. Possibly there may be a mistake in the quotation.

Mr. Hayes—I wish it distinctly understood that we did not make that quotation as a part of our report, but gave it as a quotation from a French engineer of great experience; and as an instance of the experience in making boilers on the other side of the water. Our report is substantially as it stands last year, and we simply quoted from the French engineer his own words, put them in English as best we could. I think myself that four inches is an enormous distance, but when you consider that they are placed zig-zag, it makes the distance less. It is barely possible that in translating his words, there may have been a mistake.

Mr. Sellers—I do not mean to have it understood that the committee would make such a report as that. I knew the committee would not recommend four inches from centre to centre.

Baron von Weber's Experiments on the Stability of Permanent Way.

[CONTINUED FROM PAGE 317.]

It necessarily follows that if a force be applied at one point in a line of rails, tending to produce a canting of the latter outwards, the resistance of the rails to torsion will enable them to distribute the strain amongst the spikes of the adjoining sleepers. To ascertain the influence of this distribution of the strain, Baron von Weber carried out the following experiments :

30*th Series of Experiments.* In these trials the press was arranged so as to act against the heads of the rails above the central sleeper of a portion of newly laid permanent way, the rails in this part of the line being each 18ft. long, and being fish-jointed and each spiked down to seven fir sleepers in the usual way. The results were as follows :

Pressure applied. centners. lb.	Widening of gauge. mil.	in.
10=1,134	1.5	=0.059
17=1,928	6.0	=0.236
20=2,269	8.0	=0.315
30=3,403	10.0	=0.394
40=4,537	12.0	=0.472
50=5,672	17.0	=0.669
60=6,806	19.0	=0.748
70=7,940	26.0	=1.024

With the pressure of 30 centners one spike became loose.
" " 50 " three spikes "
" " 60 " eight " "
" " 70 " eleven " "
Of which four were on one side, and seven on the other.

The distribution of the strain by the torsion of the rails had thus such an effect that about twice the pressure capable of drawing a single spike (see the 23d series of experiments, page 380) was required to produce the loosening of the first spike, whilst the loosening of the others followed irregularly. The resistance of the structure to the increase in the widening of the gauge from 8 to 12 millimetres was very great, and amounted to fully 20 centners (2,269 lb.), while at the commencement of the experiments a pressure of 17 centners (1,928 lb.) sufficed to spread the gauge 6 millimetres. The pressure against the rails recorded in the above table was subsequently increased to 135 centners (15,314 lb.), by which pressure the gauge was widened 54 millimetres (2.13 in.), and not only were all the spikes either loosened or drawn out, but the fish-plates were also twisted and bent, and the rails were canted until their axes were inclined at an angle of about 60° to the horizontal.

31*st Series of Experiments.* The above experiments were repeated on a portion of the line where the rails were disposed so as to break joint, that is to say, a fish-joint on one line of rails was opposite the centre of a length of rail on the opposite line. The rails were carefully jointed, and upon the joint sleepers, joint plates were placed beneath the rails. The number of sleepers and spikes per rail were the same as in the last set of trials, and the press was placed so as to act directly above one of the joints. Although the pressure was thus received on one side directly on a joint, the extent to which the gauge was widened agrees closely with the results obtained in the preceding experiments, as the subjoined table shows :

Pressure applied. centners. lb.	Widening of gauge. mil.	in.
40= 4,537	13.0	=0.512
60= 6,806	19.0	=0.748
80= 9,075	25.0	=0.984
100=11,344	38.0	=1.496
115=13,045	51.0	=2.008

Up to 25 mil. the widenings of the gauge were not permanent, and even when the gauge had been spread 51 mil. a permanent widening of but 6 mil. remained on the removal of the pressure, notwithstanding that almost all the inside spikes had been loosened. This Baron von Weber considers to be an important proof of the extent to which the position of the rails may be momentarily affected by the action of the traffic, and the signs of which may almost entirely disappear when the causes which affected the displacement are removed. But he further remarks that after such displacement the fastenings of the rails remain insecure, and may thus be the cause of serious accidents, for it will be difficult to ascertain to what extent the spikes have been loosened, particularly if snow has fallen, or if rain has washed sand and mud over the bases of the rails.

32*nd Series of Experiments.* These experiments were conducted on a portion of the permanent way, where the joints of the two lines of rails were directly opposite each other, and were supported by the same sleeper. The press acted directly against a pair of these opposite joints, and the results were as follows :

Pressure applied. centners. lb.	Widening of gauge. mil.	in.
10 = 1,134	6.0	= 0.236
20 = 2,269	13.0	= 0.512
30 = 3,403	19.0	= 0.748
50 = 5,672	25.0	= 0.498
70 = 7,940	38.0	= 1.496

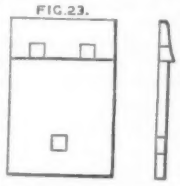
During the above experiments the displacement of the rails took place towards both sides, and when the pressure was removed, the remainder a permanent widening of the gauge of 5 millimetres. Thus a line of permanent way having the joints of the two lines of rails opposite each other, offers much less resistance to a widening of the gauge at the point where the joints occur, than a line in which the rails are disposed so as to break joint, evidently because in the former case the fish-plates are but little suitable for distributing the strain on the adjoining spikes by their resistance to torsion. This is a hint which Baron von Weber considers ought to be taken into consideration in the construction of permanent way.

Experiments on the effects of bedplates. After the preceding experiments had been carried out it became desirable, in order to complete the inquiries relating to the influence of the means usually adopted for effecting the connection between the rails and sleepers, that some experiments should be made to ascertain the effect of interposing rolled iron bedplates between the sleepers and rails. Such bedplates are generally supposed to serve three purposes. Thus, first, they render the spikes driven into the sleepers on both sides of the rail dependent on each other, it being impossible for one to be displaced without the other being displaced also; and thus it might be expected *a priori* that the resistance of the spikes to lateral displacement would be doubled. Second, the plates prevent the impression of the edge of the rail into the sleeper, an action which is often the chief reason for the rail canting; and, third, they practically increase the bearing surface of the base of the rail upon the sleeper. The experiments were undertaken to prove how far these suppositions were justified by actual results, or to ascrtain, on the other hand, whether they ought to be modified in consequence of certain influences which occur in practice, but which had not previously been taken into consideration.

In order to obtain directly comparable results, a portion of the experiments above described as having been made with rails spiked directly to the sleepers were repeated with the modification that the bedplates were interposed between the sleepers and the rails. In order to facilitate the comparison the results obtained without bedplates will be repeated in the following Tables, together with the results obtained in the experiments we are about to describe.

33d *Series of Experiments.* In this series of trials two pieces of rails were fastened, at the usual gauge apart, upon three fir sleepers, and between the rails and the central sleepers were placed bedplates of the shape shown by Fig. 23. The spikes fitted the holes in the plate well, and at the same time pressed firmly against the bases of the rails. The plates were arranged in such a manner that the side with one hole was placed towards the inside of the rails, and the press acted against the heads of the rails directly above the plates. The results were as follows :

FIG. 23.



Pressure applied. centners. lb.	Widening of gauge. Rails without plates. mil.	in.	Rails with plates. mil.	in.
15 = 1,701			1.5	= 0,059
20 = 2,269	6.0	= 0.236		
25 = 2,836	10.0	= 0 394	3.0	= 0.118

Loosening of the structure took place with the last mentioned pressure in the case of the rails without plates.

35 = 3,970	6.0	= 0,236
45 = 5,105	9.0	= 0,354
55 = 6,239	10.5	= 0,413

The loosening of the structure with the bed plate took place under the last mentioned pressure, and the complete canting of the rails was effected by a continuous pressure of 30 centners—3,403 lb. The effect of the plates in the above experimeut was very clear, and they evidently increased the resistance of the spikes to lateral displacement until the latter has been drawn out of the timber. In fact, the pressure required to loosen the structure was more than double that necessary in the case of the structure without plates.

34*th Series of Experiments.* The same arrangement as above was adopted; but bed-plates were placed between the rails and all three sleepers. The results were as follows :

Pressure applied. centners. lb.	Widening of gauge. Rails without plates. mil.	in.	Rails with plates. mil.	in.
10=1,134			1.5	=0.059
20=2,269	6.0	=0.236	3.0	=0.118
25=2,836	10.0	=0.394	4.5	=0.177
Structure loosened.				
30=3,803			6.0	=0.236
35=4,970			7.5	=0.295
40=4,537			9.0	=0.354
50=5,672			10.5	=0.413

With the last named pressure the structure with the bed-plates was loosened, and the complete canting of the rails was produced by a continuous pressure of 25 centners—2,836 lb.

These experiments confirm in a striking manner the conclusion deduced from the preceding series. The four additional plates placed upon the two other sleepers did not, however, increase the resistance to canting, for the same number of spikes had to be drawn out, and as the two plates in the previous experiments were so far sufficient to prevent the lateral displacement of the spikes, the addition of the four plates had no effect in increasing the resistance to a pressure acting against one point of the rails.

35*th Series of Experiments.* In this case, the rails were fixed upon two sleepers, bedplates being interposed between the former and the latter, and the press being

placed so as to act upon the heads of the rails midway between the two sleepers. The results are subjoined.

Pressure applied. centnrs. lb	Widening of gauge. Rails without plates. mil. in.	Rails with plates. mil. in.
10=1,134		1.5=0.059
20=2,269	13.0=0.512	4.5=0.177
30=3,403		6.0=0.236
35=3,970		7.5=0.295
45=5,105	25.0=0.984	
	Structure loosened.	

The prevention of the lateral displacement of the rails resulting from the use of the plates, was in the above instance the cause of a greater stability of the heads of the rails, but it at the same time had the effect of causing the more rigid structure to become loosened with a less widening of the gauge and a less pressure than was the case with the more elastic structure without plates was practically of no value, for before the loosening took place the gauge had been widened to such an extent that the line would have been unfit for use.

36th Series of Experiments. In these trials the rails were fastened upon four sleepers, with bed-plates, and the press acted against the heads of the rails in the middle between the central sleepers. The results were as follows:

Pressure applied. centners. lb.	Widening of gauge. Rails without plates. mil. in.	Rails with plates mil. in.
10=1,134		1.5=0.059
15=1,701	4.0=0.157	
20=2,269		3.0=0.118
25=2,836	9.0=0.354	4.5=0.177
35=3,970	13.0=0.512	
40=4,537		6.0=0.236
45=5,105	19.0=0.748	
	Structure loosened.	
50=5,672		10.5=0.413
55=6,239	25.0=0.984	
65=7,373	36.0=1.417	
70=7,940		13.0=0.512

With the last-mentioned pressure the spikes of the structure with the bed-plates became loose, and one of the rails was canted with a continuous pressures of 40 centners (=4,537 lb.) In this case the loosening of the structure with plates took place at a smaller widening of the gauge, but at a much greater pressure than that of the structure without plates; and the resistance of the structure was in fact increased by the use of the bed-plates more than 60 per cent.

37th Series of Experiments. In this series the rails were fastened down to five sleepers bed-plates being interposed, but two arrangements of the plates were tested. In the first case all the bed-plates were arranged in the same manner as in the previous experiments, that is, with the side traversed by one spike placed inside; but in the second case, the plates on the three central sleepers were turned so that the sides having two spikes were next the center of the line. Thus six extra spikes were made to act against the canting of the rails, whilst the total number of spikes securing the rails to the sleepers remained the same. The second arrangement was tested for the purpose of ascertaining the most advantageous method of placing the plates to secure stability of the structure, and the results were as follows:

Pressure applied. centners. lb.	Widening of gauge. Plates in normal position. mil. in.	Plates on three central sleepers. mil. in.
10=1,134	1.5=0.059	1.5=0.059
20=2,269	3.0=0.118	3.0=0.118
30=3,403	4.5=0.177	4.5=0.177
40=4,537	6.0=0.236	5.5=0.217
50=5,672	7.5=0.295	7.5=0.295
60=6,806	9.0=0.354	10.5=0.413
70=7,940	10.5=0.413	13.6=0.512
80=9,075	16.0=0.629	14.5=0.571
	Structure loosened.	
90=10,210		16.0=0.629
100=11,344		17.5=0.689
110=12,478		19.0=0.748
120=13.613		22.0=0.866
130=14,747		28.0=1.102
140=15,882		38.0=1.496
		Structure loosened.

The above experiments showed that the stability of the structure was practically the same for both positions of the plates up to a pressure of 80 centners. The spikes in the normal arrangement then became loose, while the other arrangement with two spikes inside the rails on each of the three central sleepers allowed a further widening of the gauge up to 38 milimetres (=1.496 in.) before the resisting power of the fastening ceased. The second arrangement of the plates thus offered a greater resistance to the destruction of the structure than that in which single spikes were placed inside the rails.

38th Series of Experiments. The following eperiments confirm the results above obtained. In this case the rails were fastened to six sleepers and two sets of trials were made, the first with the plates having the single spike at the inside of the rails, and the second with the plates on the two central sleepers reversed, that is to say, with two spikes on the inner side of the rails. The results were as follows:

Pressure applied. centnrs. in.	Widening of gauge. First arrangement of plates. mil. in.	Second arrangement of plates. mil. in.
10=1,134	1.5=0.059	1.5=0.059
20=2,269	3.0=0.118	3.0=0.118
30=3,403	4.5=0.177	4.5=0.117
40=4,537	5.0=0.197	5.5=0.216
50=5,672	6.0=0.236	6.5=0.256
60=6,806	9.0=0.354	9.0=0.354
70=7,940	10.5=0.413	14.5=0.571
80=9,075	13.0=0.512	16.0=0.629
90=10,210	17.0=0.689	19.0=0.748
	Structure loosened.	
100=11,344		20.5=0.807
110=12,478		22.0=0.866
120=13,613		25.0=0.984
		Structure loosened.

Baron von Weber considers that this rather greater widening of the gauge for the second arrangement of plates indicates that the alterations in the form of the structure should be attributed more to the lateral bending of the rails than their canting. The complete canting of the rails was effected in the case of the first arrangement by a continued pressure of 70 centners (=7,940 lb.) and in the case of the second arrangement by a pressure of 75 centners (=8,508 lb.).—*Engineering.*

[TO BE CONTINUED.]

The Central Pacific Railroad in 1870.

Messrs. Fisk & Hatch, who were agents for the negotiation of the bonds of the Central Pacific Railroad, have issued a pamphlet, from which is taken the following statement of the operations of the company in 1870, its present condition and its prospects:

At the close of the first full year of the operation of the Central Pacific Railroad as a completed line, with through connections from the Pacific to the Atlantic coasts, we are enabled to present to those interested in the prosperity of the company the gratifying intelligence that the earnings for the year 1870 (estimating for the month of December about $550,000), will reach nearly eight million dollars, of which about fifty per cent., or nearly four million dollars, will be *net*, after deducting operating expenses, being an increase in gross earnings over the year 1869 of about $2,300,000, and in net earnings, $1,300,000.

From careful and moderate estimates, based upon present indications, it is believed that the earnings for the year 1871 will exceed $10,000,000.

The following table exhibits the gross earnings, operating expenses, and net earnings, by months, from Jan. 1 to Dec. 31, 1870, estimating from December:

	Gross Earnings.	Operating Expenses.	Net Earnings.
January	$413,104	$360,919	$52,185
February	394,176	320,858	73,318
March	488,331	289,471	198,860
April	633,758	327,584	306,174
May	767,719	324,848	443,871
June	729,274	322,865	406,408
July	783,099	338,003	445,096
August	807,815	370,374	437,441
September	777,183	356,348	420,835
October	828,447	398,491	429,955
November	746,800	325,800	421,000
December (est.)	550,000	325,000	225,000
Total	$7,920,710	$4,060,564	$3,860,146

The subjoined table will show the gross earnings and operating expenses, and the number of miles operated in each year, from the commencement to the present time:

	Miles Operated.	Gross Earnings.	Operating Expenses.	Net Earnings.
1865	31 to 56	$401,941	$121,669	$280,272
1866	56 to 94	864,917	200,710	664,206
1867	94 to 137	1,470,653	330,913	1,139,740
1868	137 to 468	2,300,767	843,166	1,457,600
1869	468 to 742	5,670,822	2,993,523	2,677,299
1870	742 to 900*	7,920,710	4,060,564	3,860,146
Total		$18,629,813	$8,750,548	$10,079,265

*Including the Western Pacific (158 miles) consolidated with Central in June, 1870.

From the foregoing tables it will be seen that the Central Pacific Railroad has earned, in six years, more than $10,000,000 net over operating expenses, and nearly $6,000,000 over operating expenses and interest on the bonds; while, during four years and a half of that time, the road was under construction, without through business, and, for the first three years, with less than 100 miles in operation.

Of the earnings for 1870, at least 65 per cent. was from local business, a fact which demonstrates that the Central Pacific Railroad, is independent of the through connection for its character as a self-sustaining and profitable road, and that its net earnings from local traffic alone would more than pay the interest upon its bonds, independently of its large and increasing through business.

The lands of the company have begun to be an important source of income, although no special efforts have as yet been made toward the disposition of the lands, which are rapidly increasing in value.

The development of the resources which the company possesses, its large and valuable land grants is, as yet, but in its infancy, and it is impossible to estimate its immense importance and value as an element of strength and wealth to the company in the future.

During the past year arrangements have been perfected of great value and importance to the future business and prosperity of the Company.

In June, 1870, the original line of the Central Pacific Railroad from Ogden (where it connects with the Union Pacific) to Sacramento, and the Western Pacific Railroad, extending from Sacramento to Oakland, on the Bay of San Francisco, where it connects with the city by steam ferries, and to San Jose, where it will connect with the Southern Pacific Railroad, now in process of construction from San Francisco southward, were consolidated, and thus the main line of the Central Pacific Railroad now embraces the entire distance from Ogden to San Francisco.

The property acquired by the Central Pacific Railroad Company by this consolidation consists of 158 miles of thoroughly constructed, fully equipped, first-class railroad, running through the most populous portion of the State of California, and connecting its chief cities of Sacramento, Stockton, Oakland, San Francisco and San Jose, together with very valuable and important waterfronts, wharves, warehouses, and ferries at Oakland and San Francisco.

Its present value at a fair estimate is $12,000,000, and its first mortgage debt, assumed by the Central Pacific Railroad Company, is but $2,735,000.

Since the consolidation over $900,000 have been expended in improving the water-front, and upon the wharves and warehouses at Oakland, which are now among the most substantial and permanent structures of the kind in the country.

In August, 1870, a further consolidation was perfected between the Central Pacific Railroad Company, the San Francisco, Oakland & Alameda Railroad Company, the California & Oregon Railroad Company, and the San Joaquin Valley Railroad Company, by which all the most valuable railroad franchises on the Pacific coast, and, in fact, almost the entire railroad system in California, became merged and vested in the Central Pacific Railroad Company.

The San Francisco, Oakland & Alameda Railroad is of great importance and value to all the others, as one of the keys to the coast terminus of the main line of the Pacific Railroad and its various feeders; and connected with it are also valuable water fronts, ferry privileges, three steam ferries, and other important grants and franchises.

It is worth, at least, $5,000,000, and its indebtedness was but $1,500,000.

The line of the California & Oregon Railroad, commencing on the main line of the Central Pacific at Roseville, 16 miles east of Sacramento, extends in a northerly direction up the rich and fertile Sacramento Valley to the Oregon boundary, and will be the natural outlet to San Francisco, the metropolis of the Pacific coast, for a very large section of country, now rapidly filling up, embracing Northern California and Oregon.

It is already completed and running to Tehama, a distance of 107 miles, and considerable additional work has been done beyond this point, which, together with the iron for fifty miles additional, and other materials on hand and paid for, represent an expenditure of $6,500,000.

The road, when completed, will be about 312 miles in length. Connected with it is a very valuable land grant, from the United States, of 12,800 acres, to the mile, or nearly 4,000,000 acres in all, consisting to a very large extent of lands of superior value and fertility, and available for immediate and rapid settlement as the road progresses.

The value of the road when completed, with the lands, may be fairly estimated at $30,000,000, and its revenues must be very large.

The San Joaquin Valley Railroad bears the same relation to the main line toward the South that the California & Oregon does toward the North.

Its route, commencing on the main line near Stockton, runs in a southerly direction through the great San Joaquin Valley, a distance of 290 miles. Of this road, about 25 miles have been completed, which, with additional work done at various points on the line, have cost $1,500,000, and is entirely unencumbered.

The foregoing consolidations, insuring as they do a common interest, unity of action, and a comprehensive and harmonious system of operations between the Western half of the main line of the Pacific Railroad and all its feeders west of the Rocky Mountains, are of vast importance to the future of the Central Pacific Railroad Company, and add strength and value to the securities of all consolidated companies.

MISCELLANEOUS.

—The Cleveland & Pittsburgh Reading Room Association has been organized at Wellsville, Ohio, by and for the benefit of officers and employes of the Cleveland & Pittsburgh Railroad Company, and proves a useful institution. The fourth annual report, just issued, makes the following exhibit: One hundred and seventy-six members; cash receipts $287.83, and increase of $17.91 over the year 1869; expenditures of the year $227.02; ninety new books bought and two donated; the library contains 624 volumes; the latest magazines and papers are on the file in the reading room. This is said to be the first institution of the kind established in the United States.

The officers are: Wm. Stewart, President; Jno. Thomas, Vice President; W. G. Brownson, Secretary and Treasurer; Directors, M. Quinlan, N. E. Chapman, J. E. Conrad, Johy Kennedy, J. R. Stoakes, E. Pierce, P. Bruner, V. Chapman, R. F. Smith, Thomas Dickson, Thomas Carlisle, George Skinner.

—A countryman in England happened to be traveling in a railway train, accompanied by his wife, when a collision happened. His wife received a severe contusion between the eyes, for which the jury awarded £50 damages. Some time after the following was elicited from the plaintiff in a moment of unguarded conviviality: "Well, you see't collision happened t' ould woman and I wur all feet: but when I got o' t' carriage I saw a lot o' fellows in a terrible state. One sings out, 'Eh lad, I've gettin' my head cut open, I'll ha' twenty peownd for this.' 'Twenty peownds,' cried another, 'I'se gettin' my shoulder out, I'll have forty for it.' 'When I heard this,' continued the clever business man, 'I jumped at 't ould woman straight out, and druv my head right between her eyes, and we're gettin' fifty peownd for 't."

—At the annual *soiree* af the *employes* of the Lancashire & Yorkshire Railway, on Saturday, the Chairman of the company, Mr. George Wilson, stated that they lost one servant every fortnight by accidents which in nine cases out of ten, where the result of disobedience to the rules or carelessness in the discharge of their duties.

—The north island of New Zealand has adopted a gauge of 3 ft. 6 in. for its railways. In the province of Canterbury, in the south island, the gauge selected is 5 ft.

English Criticism of Mr. Fairlie's "Gauges of the Railways of the Future.

The following is a letter to *The Engineer*, criticising the paper read by Mr. Fairlie before the British Association, which we criticised editorially some weeks ago:

Mr. R. F. Fairlie's paper on this subject having hitherto remained almost unnoticed in *The Engineer*, I beg, with much deference to its able author, to make a few remarks on the extravagant theories it contained. Mr. Fairlie, in the first place, says "that while a narrow gauge railway is infinitely less costly than a broader one, its capabilities in respect of power and speed are fully equal to the wants of the country;" which explicitly is to say that a 3 ft. gauge would be *infinitely* less costly than the 4 ft. 8½ in. Now, allowing for the hyperbole, the question is simply this: If both railways were constructed *strictly similar* in all things, save the gauge, does it follow that the cost of one should materially differ from that of the other? The only necessary difference is the increased length of the sleepers—about one-third more for the broad gauge—but will not this extra length compensate for a reduction in their width, and so give the same stability to the line, with the same quantity of material, and without perceptibly increased cost? Provided that the rolling stock on both lines shall be alike in all things, except the length of the axles, one should be constructed *very nearly* as cheaply as the other. When Mr. Fairlie has completed his designs for the rolling stock of the 3 ft. railway, and has his train ready to start, let him substitute axles 4 ft. 8½ in. long for those of 3 ft. (slightly increased in diameter to give equal strength), and place the train on the other line; then I shall ask him how much the weight of his train has been increased by the change, and whether it will not carry as much paying weight as before? Can it be said that "the proportion of non-paying to paying weight is increased exactly as the rails (wheels) are farther apart, and that the "ton of materials is spread over a wider basis?" The gauge is increased 57 per cent., but the weight of the train not more than 3 per cent. This is not in "direct proportion." The greater steadiness of the train, and facility of arranging the parts of the engine, will in practice, fully compensate for this very slightly increased weight. The train would not require a greater width of cutting or embankment, or higher bridges and tunnels on one than on the other.

The light rolling stock so designed would obviate the great disproportion of paying to non-paying weight on the standard gauge, and gain all the advantages claimed for the narrow one, without being subject to its inconveniences. Engines with very small driving wheels cannot run at a great speed without considerable loss of power caused by back pressure. Mr. F. does not say of what diameter he would make his drivers; but, referring to *The Engineer* (May 6th, 1870), where Mr. Spooner makes them for the 2 ft. 6 in., a gauge one-third, or 3 ft. 4 in. diameter, the author of the articles on the Festiniog Railway (September 24th, 1869) suggests the use of wheels 3 ft. diameter for a 2 ft. line. The impossibility of making the driving wheels sufficiently large to run at the ordinary speed of forty miles per hour must always be encountered on the narrow gauge, from the necessity of placing the boiler over the top of the wheels when it is broader than the gauge. To increase the diameter of the wheels must in a corresponding degree raise the centre of gravity, and render the engine less steady. No one would design an engine for the standard gauge with its boiler perched above the periphery of wheels from 6 ft. 3 in. to 7 ft. high. Possibly an engine so built might run at a high speed with a considerable degree of safety, but not without excessive oscillation; yet that engine would not have its centre of gravity proportionately higher than that of those built in like manner for the narrow gauge. It need not be mentioned that on a gauge wide enough to permit boilers of ordinary dimensions to come between the wheels this difficulty will not occur; and, consequently, the engine may be adapted for running at a high speed, and with greater economy than if the diameter of the wheels were unduly limited. It is very possible that a light train may carry a paying weight in the ratio of three to one; but it remains to be proved *practically* that it can, with buffers and couplings of the most approved pattern, survive the rough usage attending the ordinary speed. But Mr. Fairlie *proves* that his train cannot carry three times its weight. On the Festiniog Railway the dead weight of a train is in the ratio of one to three; now, if that gauge were increased 50 per cent. (3 ft.) and the *dead weight in direct proportion*, the train can only carry twice its weight, or a 30 cwt. wagon carry 3 tons. The 2 ft. gauge of that railway, so often alluded to, is not in itself a necessary element, but an accessory to that great financial success, the 12 per cent. dividend so novel to railway shareholders. At the same time the gauge has constrained the engineer to the three cardinal points of railway economy—cheap construction, light rolling stock, and low speed. This railway, first a horse tramroad, cost about £2,600 per mile; the cost for adapting it for its present use, including all improvements, locomotives, carriages, etc., does not exceed £7,000 per mile.

To show that a 4ft. 8½in. railway may be made as cheaply, it is only necessary to give one example. Captain Tyler's report to the Board of Trade on the Duke of Sutherland's Railway is to the point (see *The Engineer*, November 11th, 1870). The cost of this line is only £3,700 per mile; but as the greater part, or the whole of it, is constructed through the Duke's own estate, it may be inferred that this amount does not include the cost of the land required; and probably this sum does not contain provision for an adequate supply of rolling stock; but making a liberal allowance for these two items, the total cost per mile will not exceed that of the Festiniog Railway. On the question of light rolling stock, there is no difference in principle; it is in the first place, much cheaper, and must show favorably in the maintenance of the permanent way. It is to be hoped that the days of the ponderous machines of 45 tons are numbered. For light railways the Fairlie engine will be invaluable. The extension of the same principle to the carriage would be another improvement.

The question of speed entails the same consideration; every increase in that direction requires that the permanent way should be stronger; that curves of a greater radius be provided; and that the gradients should be easier, to carry heavy trains at a greater speed, with the same degree of safety.

With double bogie rolling stock, curves of a minimum radius will be as admissible, running at a low speed on the standard gauge, as on a narrower one.

The State vs. Baltimore & Ohio Railroad.

The case of the State of Maryland against the Baltimore & Ohio Railroad Company, the trial of which has excited so much attention, not less on account of the large sum of money demanded and refused, than of the constitutional questions involved, came to a sudden termination in the Superior Court on Friday morning by a decision of Judge Dobbin, which left the finding of a verdict for the defendant by the jury a mere matter of form. The opinion of the court will be read with profound interest in every part of the country, because one of the questions decided is of national importance, and appertains to the rights of every citizen of the United States. It has been solemnly adjudged that the right to travel cannot be taxed, and that whatever sum the passenger is required to pay over and above his regular fare by reason of the reservation of any part of the passage money to the State is a *tax*, and as such cannot be collected. It matters not in what form the stipulation between the State and the transportation company may be put, or by what name the sum which accrues to the State is called, if the effect of it be to increase the fare it is a tax upon the privilege of travel, and as such is repugnant to the Constitution of the United States.

Judge Dobbin argues the case from the standpoint of the citizen who pays the tax, and his reasoning seems to be clear and conclusive; and although the effect of the decision will be to deprive the State of a large and important source of revenue, yet the justness of the principle on which it is founded will be generally admitted. Within the last thirty years many millions of dollars have been paid into the Treasury of the State of Maryland by the citizens of other States under the provisions of the act of 1832, which, regarded in the light of Judge Dobbin's decision, was nothing more nor less than a tax upon the privilege of passing through the State; and it seems most singular that in all that time the question as to the legality of the tax was never raised. The amount exacted from each individual was so small that no one thought it worth the trouble of refusing to pay; but the United States Government paid hundreds of thousands, probably millions of dollars for the transportation of soldiers, and in all the statements no accounting officer ever appears to have raised the point. The decision, however, will no doubt affect the claims of the company for transportation, which are still pending before the Auditing Department.

The second question ruled upon by the Court, to the unprofessional mind is not so clear. Inasmuch as the company has collected the money, it seems to be in accordance with natural equity and justice that it should be paid over to the State. The grounds upon which Judge Dobbin made a decision to the contrary may be well considered, and be supported by the weight of legal authority; but it does seem that the cases cited by the plaintiff's counsel have a strong leaning to a contrary doctrine.

There is one ground, however, on which Judge Dobbin bases his decision, which, if well taken, is conclusive; and that is, that the money illegally exacted belongs to the passengers who have paid it. Of course it cannot belong to two parties at the same time, and if it is the passenger's it cannot be the State's. As a practical question, the fact that it belongs to the passengers amounts to nothing at all, because no considerable part of it could ever be recovered. As a question of law, however, it estops the State from setting up a claim to the money. We presume that now, in view of the decision, the company will immediately reduce the rate of fare to Washington, and therefore refuse the further collection of a tax that does not belong to it.

There is another fact connected with this decision that is worthy of mention, and that is the gradual melting away of the extreme doctrine of State Rights. Year after year the Supreme Court of the United States has been asserting the rights of the citizens of the United States, as against all the State enactments that would seek to abridge them, and this last dictum of an orthodox Maryland court is not the least emphatic. The right which every citizen of the United States has to travel to the capital of the country, or to whatever other place he chooses, cannot be taxed, either by an express levy per capita, or by a provision in a railroad charter that increases the price of his passage. This decision, when viewed in the light of the times when there were gentlemen of intelligence, and even lawyers of ability, who asserted that the citizens of the United States had not even the right to cross Maryland soil without her permission, seems strange indeed.

———After the above was placed in type we received an announcement that "in pursuance of the purpose "announced in the report of the Finance Committee, "the Baltimore & Ohio Railroad Company has or-"dered an immediate reduction of twenty per cent.—"the whole amount of the State tax—to be made on "the fare of $1.50 now charged between Baltimore and "Washington, thus reducing the fare between the "points named to $1.20. This reduction will com-"mence Saturday morning. A corresponding reduc-"tion has been ordered in the fares at the several sta-"tions on the Washington Branch." This action of the railroad authorities will give general satisfaction to the traveling public.—*Baltimore American.*

How Some Railroad Officers Make Fortunes.

It is unfortunately true that there is scarcely one great corporation in ten, and especially railroads, that is not beset and devoured by *parasites*, in some or other of their various shapes. The salaries of officers, though they sound large, are often but a small part of the amount actually realized from all sources. A gentleman well informed in such matters, at the time himself a railroad president, gave us the names and the particular source of revenue of the officers of several large companies. In one instance, we remember, the President had an inside contract for carrying all the barley that passed over his road; another the contract for the lumber, and several were owners of fast express companies, which proved most prolific sources of wealth. More recently the practice has become common of secretly buying largely of the stock of low-priced and unproductive companies, and of merging them at much higher figures with companies of real value to the great profit of the manipulators. Profits resulting from the purchase of lands in the vicinity of sites for machine shops and points selected for depots are looked upon as legitimate gains to those on the inside and having the foreknowledge. Probably, however, as bald an exposure of hands in nefarious transactions of the parasite character, is the recent dividend of company lands by the New Jersey Central Railroad Company. This company, after having previously closed its transfer books, decided to divide among those who were stockholders at such closing three millions of land company scrip, representing the lands owned by it on the line of the road, on which $30 per share is declared to be paid up, which scrip is all owned and guaranteed by the railroad company. The arrangement is said to be as follows: Each holder of say 100 shares of stock receives $2,000 of scrip at par, on which $600 is declared to have been paid, which payment, of course, is a fiction, and on this there remains to be paid, when called for by the railroad company, $1,400, making the value of the dividend, or privilege, if the scrip be worth par, six per cent. If the scrip be worth only $70, or less, the subscriber gets nothing, or may be the loser. In other words, the stockholders of the Central Railway, who were such on the day of closing the books, have the privilege of taking the scrip at the rate of 75 cents on the dollar, instead of any dividend. The effect of this disinterested movement was a decline of four or five per cent. in the open market. The unfairness of this transaction attracted the attention of the New York Stock Exchange, which body has declared that it shall be of no effect, as against the buyers of the stock since the close of the transfers. And this "allotment" being made public for the first time six days after it was made, the brokers, who have been sellers of the stock since, whether for account of the President or directors, who were cognizant of an "allotment," or for "any other man," are ruled to be liable for the "allotment," or scrip dividend, and required to immediately issue their due-bills therefor.—*Philadelphia Ledger.*

Serious Charge Against an Illinois Railroad Superintendent.

A friend sends us the following, cut from some paper in the interior of the State:

About a year ago a man living near Havana had a cow run over on a public crossing by a train belonging to the Peoria, Pekin & Jacksonville Railroad. He tried to make the company pay for his animal, but was informed that if his cow strayed on the track at a public crossing, it was her own lookout and the road was not liable. Day before yesterday the same man appeared at the office of the General Superintendent, in Pekin, in a high state of excitement. "Where's the Superintendent?" cried he in a voice like a mad bull. "I want to see the Superintendent." The attorney of the road happened to be the only official present, and he, after explaining that the Superintendent was out, said that if he (the attorney), could do anything for him it should be done. Whereupon the irate individual delivered himself as follows: "About a year ago I lost a cow, got on a public crossing, up comes a train, runs into her, kills her, company wouldn't pay no damages, said they couldn't stop their train. Now on yesterday I crawled on my hands and knees mor'n three-quarters of a mile after a goose, shot it, an' it happened to fall on that same identical crossin' where you killed my cow. 'Long comes a train. That train stops, picks up my goose, and goes ahead. Now," he said, growing more excited, "what I want to know is, if you could stop your train to steal my goose, why couldn't you a stopped to save my cow. I want that goose. It's my opinion that the Superintendent of this road (smiting the table in front with his right hand) is the fellar that's got that goose, an' I want him. Any man that's mean enough to kill a cow and steal a goose, 'll lie about it afterwards. Ye needn't tell me. I want that there goose." The attorney hastily explained that he had nothing to do with the matter and got rid of the affair by sending the man up to the Superintendent's house after his bird. The last seen of him, he was marching up the street muttering to himself, "I want that goose."

—A telegram from Nashville says that a rail was torn up and thrown into a ditch on the East Tennessee & Georgia Railroad, near Cleveland, Tenn., one day last week, and an east-bound passenger train, with passengers from all parts of the South, going at lightning speed, passed over the brake and regained the rail without the displacement of a single wheel, or damage of any kind, except the breaking of one of the springs of the engine.

MISSISSIPPI AND TENNESSEE RAILROAD.

Report for the Year Ending September 30, 1870.

The Mississippi & Tennessee Railroad extends from Memphis, Tenn., in a southeasterly direction to Grenada, Miss., a distance of 99 miles. At the latter place it connects with the Mississippi Central for New Orleans.

The following summary of this report we copy from the Memphis *Avalanche*.

The fourteenth annual report of the President and Directors of the Mississippi & Tennessee Railroad Company to the stockholders has been issued. The President, Mr. F. M. White, in his report states, that during the year ending September 30, 1869, the gross receipts of the road were $385,974.92, and during the one ending September 30, 1870, the gross receipts were $510,919.34, showing an increase of $124,944.42. The net receipts of the former year were $152,232.35, and the net receipts of the year just ended amounted to $212,504.71 showing the very satisfactory increase of $60,271.76.

"It is true the operative expenses have been increased in proportion and a little more so, to the increase of gross receipts, but the increase is explained and accounted for by our General Superintendent in his report. In the item of conducting transportation which last year was $54,695.53 and this year $74,235.72, showing an increase of $19,540.19, caused by the opening of foreign agencies, increased labor and expense at stations, and other items necessarily incident to increased business."

The items of motive power last year amounted to $92,134.09; in the year just ended they were $116,036.02, showing an increase of $23,901.93. Over $11,000 of this increase was in the one item of wood for locomotives, and our Superintendent reports about 3,400 cords now on hand. The remainder of the increase is explained by increased business and the unusual quantity of work done in the machine shop, rendering it necessary to employ a greater number of machinists, and laborers, and engineers, and firemen than we had the year before. Besides, Motive Power shows one locomotive rebuilt and another partially rebuilt during the year.

Maintenance of way last year was $62,409.61, and in year just ended, $89,088.20, showing an increase of $26,678.61.

Two new locomotives have been purchased and are in use. Commodious freight depots of brick have been built at Memphis and Grenada. In conjunction with the Mississippi Central Railroad, a rolling mill has been put in operation at Grenada.

"The distance through Memphis from Cairo and Louisville to New Orleans is only eighteen miles further than the route by Humboldt and Jackson, Tennessee, and with connection at the depot we could very well compete with that route; as it is, the great tide of through travel leaves the Memphis & Ohio road at Humboldt, leaving the city of Memphis out of its line."

RECEIPTS OF THE ROAD

for the last corporate year are as follows:

From passengers	$203.115 00
From freight	293,604 37
From express	5,000 00
From mail	7,580 00
From privileges	1,699 97
Aggregating	$510,919 34

THE OPERATING EXPENSES

For conducting transportation	$ 74,235 72
For motive power	104,824 52
For maintenance of way	86,928 20
For maintenance of cars	32,426 19
Aggregating	$298,414 63
Leaving net receipts	212,504 71

The increase of passenger receipts over the year ending September 30, 1869, is $37,247.92, and the increase of freight receipts, $87,262.18.

The treasurer's report shows that the funded debt of the company now amounts as follows:

First mortgage 7 per cent. bonds	$600,000
Consolidated 8 per cent. bonds	1,179,500
Income 10 per cent. bonds	2,000
State of Tennessee loan 6 per cent. bonds	409,318
Aggregating	$2,190,818

On that funded debt interest has been paid amounting to $153,850.75 during the year and the net receipts of the road were ample for this purpose.

The report closes as follows: "We expect hereafter to regularly and promptly pay all interest on our bonds as the same become due, and have a reasonable expectation that a sufficient surplus of net receipts will remain over which will pay for the necessary improvement of our road and gradually extinguish our floating debt. As it is, our floating indebtedness has neither been diminished nor enlarged materially from what it was at our last report. Its items are as follows:

Bills payable	$124 908 39
Bills payable in freight	121 78
Mississippi two per cent. fund	20,949 07
Circulation	94,260 52
Pay roll unpaid	18,585 93
Unpaid vouchers	15,088 27
Due United States	30,080 26
Individual account	64,491 52
Making in all	$368,485 74
Deduct cash on hand	15,413 90
Amount due Gayoso Saving Institution ($80,000.00) paid by Tennessee bonds in its hands	41,323 75
	$56,737 65

Will leave $311,748.09 the actual floating indebtedness of the company, a portion of which, being old debt of the company, will eventually be merged into funded indebtedness.

—A large number of citizens of Little Rock made an excursion over the 20 completed miles of the Cairo & Fulton road last week on invitation of the Chief Engineer, Mr. A. P. Robinson.

Overworking Locomotive Engineers—Limitation of the Speed of Freight Trains.

The following is a communication addressed by the Brotherhood of Locomotive Engineers to the Master Mechanics' Association:

The locomotive engineers of the country being intimately connected with you in operating railroads, and being desirous of maintaining the utmost harmony between their officials and themselves, and well knowing the immense influence your convention will have in establishing any measures that may be recommended by your honorable body, and being requested to call your attention to some points that are regarded as important by the Brotherhood of Locomotive Engineers, we have taken the liberty to address you this letter.

First—Your attention is most respectfully called to the practice of engineers being overworked, either by their desire to make extra time, or by being compelled on account of press of business on the road to run extra trips without proper rest.

It is a notorious fact that very many of the accidents occurring are on account of the engineer being asleep or sleepy, and in some cases no doubt they have been overworked, and could not reasonably be expected to keep awake. A recent accident is reported where the engineer had been for fifty-one hours on duty without sleep, and many others of a similar character are of too frequent occurrence.

It is earnestly hoped that your convention will pass some recommendation that will obviate the recurrence of this cause of accidents, and consequent disgrace to the engineers.

Second—Your attention is called to the policy now in vogue of reducing the speed of freight trains to a very slow rate, and of strictly requiring the engineers to observe the exact schedule rate of speed upon all parts of the road without any regard to grades, or length of time it may take to make a meeting place, or reach the terminus of the line.

It may be said that this matter belongs to another department of the management, but it is believed that all will admit that it is intimately connected with the financial success of the mechanical department upon all railroads.

Any practical locomotive engineer knows that a locomotive with a five foot wheel (the usual size), will not work economically at too low a rate of speed, and that no benefit can be derived from expansion until the engine attains a more rapid motion than eight or ten miles per hour. Link-valve motions are so constructed that the lead of the valves is materially increased by cutting off the steam, and a too low rate of speed will not overcome the back pressure of the piston at the end of the stroke, or allow the crank to pass the center easily, consequently it is much more severe work, and more expensive for the engine to run at a very slow rate of speed than it would be to run at a reasonable rate, say fifteen miles per hour, for a five foot wheel engine.

Then again, to be required upon all occasions to run at a uniform rate of speed very materially increases the expense of hauling heavy freight trains over all railroads that are built with numerous and variable grades. The advantages of a little headway in approaching a grade, especially if it be a short one, must be apparent to every person that ever rode upon a locomotive, and the folly of setting brakes upon a train to prevent its running down a grade faster than eight miles per hour, when there is another grade to ascend as soon as the down grade is passed, is, to say the least, poor economy, and is a cause of increasing, unnecessarily, expense of fuel, and is much more severe upon the machinery of the engine, while it does not in any way conduce to the safety of the train or the permanency of the track. The remark of the illustrious Stephenson before the English Parliament in regard to the immense strain upon the track or a bridge at a high rate of speed, aptly illustrates the fallacy of the opinions of many men in regard to speed of a railway train. He compared the passage of a train over the track or a bridge to a person skating upon thin ice. The ice sustaining the skater at a uniform and rapid speed that would not hold for a moment under the shackling gait that many trains are required to approach and pass bridges.

We do not wish to be understood as advocating reckless or fast running for freight trains. We think there is intelligence and practical experience possessed by the members of your convention sufficient to know that to run a heavy freight train economically and safely, the engineer must or ought to be invested with power to use some discretion in regard to speed upon parts of the road. A little leniency in present rules, would often allow a train to safely make the meeting place, and thereby save hours of time for the engine being on the road, and afford the opportunity of rest to all the men employed upon the train.

It is hoped that your convention will not pass over this matter as being out of their province. It is intimately connected with the expense account in your department, and it is clearly a matter that a mechanic should pass his judgment upon.

Much more might be said to show the folly of requiring a heavy freight train to be always run at a uniform rate of speed, but knowing that we are addressing this communication to men who have been, many of them, practical engineers, we do not think it necessary to do more than call your attention to the subject.

Hoping that your honorable body may be induced to give this subject the attention it demands, and assuring you that the engineers are anxious to carry out any suggestions you may have to make, believing that your convention will be productive of great good to the railroad interests of the country.

We most respectfully submit this communication.

CHARLES WILSON, G. C. E.
CHARLES FELLOWS, F. G. A. E.

This communication was referred at its last annual session to the Committee on Correspondence of the Master Mechanics' Association which directed the Secretary to return the same, the subject referred to being beyond their province for action.

Boiler Incrustation.

The following is the essential part of the report on boiler incrustation made at the last meeting of the Master Mechanics' Association, by H. A. Towne, Superintendent of Machinery of the Hannibal & St. Joseph Railroad, made entirely from his own experience, by accident no reports having been secured from other master mechanics:

In looking over the reports of last year I find statements from twenty-three master mechanics, all of which differ more or less, some believing one thing, and some another, to be good in removing scale in boilers. These opinions, though they differ, may not all be erroneous. On the contrary, they are probably correct, as it is well known that there are numberless compounds that will soften and perhaps remove incrustations. Admitting that it will do so, nothing seems to be accomplished by this method of removing it, because a large proportion of the scale still remains in bottom part of boiler and around the flues, thereby preventing a free circulation of water, which necessarily retards evaporation just in proportion to the amount of mud and scale accumulated.

Besides the use of compounds that will operate so quickly upon this scale, must have a greater or less injurious effect upon the iron, as the experience of many of our most able mechanics has proved.

Locomotive boilers are from necessity so constructed as to render it extremely difficult, if not impossible, to wash out all the sediment, especially that lodged in cylinder part of the boiler and around the flues. Therefore all powders or other compounds introduced into a boiler, adds still more to this already destructive element which we so much desire to get rid of.

I believe the only way to prevent incrustation is to purify the water before it enters the boiler, and the accomplishment of this result will be the "*ne plus ultra*" of this important subject.

I am not prepared to enter into a detailed, scientific, chemical analysis of water, and all its various effects upon different roads throughout the country. I only desire to present a practical view of the subject as it appears to me. It is then sufficient to know that the only practical way of purifying water is through the agency of heat. Decomposition takes place at a temperature of 212 degs. (Fahrenheit), and while all the impurities are thus set at liberty, the next thing to be attained is to extract and remove them from water (by means of some outside apparatus or attachment arranged for the purpose), before allowing it to enter the boilers.

The Stilwell & Doughty heaters came nearest to the accomplishment of this purpose of any apparatus of the kind I have ever seen, and I believe the principle upon which these heaters are constructed is correct. But it may be said that this method of purification is entirely impracticable for a locomotive boiler, which is evidently the case. Yet I believe a still more effectual apparatus can be applied to locomotives, and until this is done we must put up with mud, scale, incrustation, ruptures, blisters, and finally, explosions, with all their fearful consequences.

Volumes might be written on boiler incrustation, its origin, causes and effects, and after the perusal of such a production one would scarcely see that the subject had been commenced. It would seem then only necessary to point out a few of the causes of so great an evil, and apply the *only* remedy, which, I believe, is suggested in the foregoing.

The First Locomotive in America.

The first locomotive that ever did service in the United States is now lying outside of a foundry at Carbondale, Luzerne county. It ought to be preserved somewhere as an interesting relic of the early days of railroading. The following description of its trial trip, taken from Dr. Hollister's History of the Lackawanna Valley, will be read with interest:

The first locomotive engine introduced and worked in America, was run upon the Delaware & Hudson Railroad. In the year 1828, and Honesdale (named from the late Philip Hone) offered its friendly glen for the purpose of conducting the experiment. This locomotive, called the "Stourbridge Lion," was built in England, of the best workmanship and material, and most approved pattern of that date. The road passed out of Honesdale by a sharp northwesterly curve, with a moderate grade, and was carried over the Lackawaxen by a long hemlock trestling, considered too frail by many to support the great weight of the mysterious looking engine all ready for the hazardous journey.

As the crowd gathered from far and near, expecting that bridge, locomotive and all, would plunge into the stream the moment passage was attempted, no one dared to run the locomotive across the chasm but Major Horatio Allen, who, amid exultation and praise, passed over the bridge and a portion of the road in safety. The engine, however, was abandoned, as the slender trestling forming much of the body of the road, sufficiently strong for ordinary cars, was found too feeble for the "weight and wear." Major Allen in his account of this first trip of a locomotive on this continent says: "As I placed my hand on the throttle, I was undecided whether I would move slowly or with a fair degree of speed; but believing that the road would prove safe, and preferring, if we did go down, to go down handsomely, and without any evidence of timidity, I started with considerable velocity, passed the curve over the creek safely, and was soon out of hearing of the vast assemblage. At the end of two or three miles I reversed the valve and returned without accident, having thus made the first railroad trip by locomotive on the western hemisphere."—*Exchange.*

General Railroad News.

TRAFFIC AND EARNINGS.

—The traffic receipts of the Grand Trunk of Canada for the week ending December 3 amounted to £36,200, against £34,800 in the corresponding week of last year, showing an increase of £1,400.

—The receipts of the Great Western Railway of Canada amounted to £18,053, against £17,760 in the corresponding week of last year, showing an increase of £293.

—At the annual meeting of the holders of first mortgage bonds of the Vermont Central Railroad in Boston lately, the earnings of the road for the past year were reported at $2,084,884, and the running expenses $1,495,907, leaving a balance of $588,977. The receipts from all sources were $2,571,814, and the disbursments, including additions to the equipment, $2,553,880. The assets amount to $578,588. The report closed with a proposition submitted to the bondholders' consideration, for a return of the active management of the road to the stockholders.

—The shipments of Lake Superior iron ore from Marquette and Escanaba during the past season were as follows :

Escanaba	451,385 tons.
Marquette	423,197 "
Total	874,582 tons.

The shipments of pig iron were :

Escanaba	15,293 tons.
Marquette	30,559 "
Total	45,852 tons.

OLD AND NEW ROADS.

Knox & Lincoln.

The bridge over the Nequasset river (Maine), was crossed for the first time, on the 29th ult., by a train consisting of eight cars, two of these being flat cars laden with fifteen tons of railroad iron each, being transported ahead of the engine. The bridge is 800 feet in length, and is in every respect well constructed and substantial. The rails now extend three-fourths of a mile beyond the bridge.

Michigan Air Line.

The last rail was laid on this road, between Niles and Jackson, on the 3d inst., and Mr. Sargent, Superintendent of the Michigan Central, went this week to inspect and take charge of it. A mail train and freight will run over it for the present, and a car in connection with the Kalamazoo accommodation, will run as far as Three Rivers.

Portland, Rutland, Oswego & Chicago.

The directors of the company met at Portland on the 28th insttant, and organized by the choice of John A. Poor as President, and John Neal as Clerk and Treasurer. The location of the line by way of Buxton Centre, Moderation and Cornish, to the line of New Hampshire, in Freedom, was adopted, the surveys of which have just been completed. Plans and surveys of the line across the States of New Hampshire, Vermont and New York, to Oswego were presented, and necessary measures adopted to carry forward the work of location, and other measures agreed on to insure the carrying forward of the line. The members present were Messrs. McEchron, of New York, Cain, of Vermont, Judge Fowler of New Hampshire, and Messrs. Poor, Rice and Lane, of Maine, with other parties interested from out the State. Messrs. McEchron and Lapham, of Glen's Falls, presented plans of the elaborate survey from Fort Ann to the summit near Piseco lake, a distance of seventy eight miles, showing no grades exceeding thirty-five feet to the mile going east, and none exceeding sixty feet to the mile going west.

Massachusetts Railroads.

The Massachusetts Legislature of last year passed a law providing that the statistics of railroads, which are required to be presented to that body in January of each year, should be made up to the 30th of September annually, instead of to the 30th of Nov., as had heretofore been the custom. Under this arrangement the reports of 1870 will only include ten months. The following are some of the statistics :

Old Colony Railroad—Total debt, $2,986,600 ; total income, $1,276,848 ; net earnings over expense, $297,354 ; assets in stock, loans, cash and bonds, $325,000.

Boston & Albany Railroad—Capital stock authorized, $26,000,000 ; total funded debt, $1,798,520 ; total floating debt, $470,000 ; total both, $2,268,520 ; total cost of road and equipment, $21,938,528 ; total miscellaneous expenses, $2,306,829 ; total income, $5,785,987 ; net earnings over expenses, $1,830,313.

Boston & Providence—Capital stock authorized, $4,000,000 ; total funded debt, none ; total floating debt, none ; total debt, none ; total cost of road and equipment, $3,700,000 ; total expense of maintenance of way, $106,906 ; total income, $1,049,125 ; net earnings, $278,807.

Boston, Hartford & Erie—Income from passengers, $201,740 ; income from freight, $264,822 ; income from rents and mails, £5,200 ; total income, $470,732.

West Chester & Philadelphia.

The Delaware County, Pa., *American* says : "The annual report of this road is not yet printed, but we learn that the passengers for the year 1870 amounted to 681,601, a heavy increase, as shown by the fact that during 1868, when the road combined all the business of the Baltimore Central, there were but 660,595, and in 1869, for ten months, with four months' Baltimore Central business, but 598,363. The total number of excursionists for the year just closed reaches 46,136, an unprecedented number. This increase of travel has been on the shorter ends of the road, and is co-extensive with the increase in population, showing the wisdom of the present management in affording increased facilities for those constantly doing business in the city. The operating expenses of the road for the past twelve months have been less than the ten months preceding, notwithstanding the re-erection of the bridges over Ridley Creek and Rocky Run.

Erie Railway.

The managers announced, on the 28th ult., that the business of the United States Express and Great Western Despatch Companies, over their road, will cease March 1st, after which the New York & Boston Express Company will extend operations over the Erie road.

Kalamazoo & South Haven.

The last rail was laid last month, completing the road to South Haven. Regular passenger trains commenced running last week. The road has been operated for some months past from Kalamazoo to Garnett, where the Chicago & Michigan Lake Shore road crosses it. The new road from Garnett to South Haven is about seven miles long. The line is owned and operated by the Michigan Central. Its total length is about 42 miles.

Lexington & St. Louis.

We learn from the St. Louis *Republican* that Mr. Wm. Morrison, of Lexington, President of the company, has made arrangements providing for the payment of interest on all outstanding indebtedness, and that the prospects for building the road are good. Negotiations are being had with the Pacific of Missouri Company to finish the road, and it is hoped that the construction will be completed within the next eight months.

Atchison & Nebraska.

Twenty-eight miles of the road, northward from Atchison, is completed and regular trains are running. The track is being rapidly laid beyond and probably by this date has reached White Cloud, near the Nebraska State line. A transfer ferry boat began, on the 27th ult., carrying cars across the river at Atchison.

Burlington & Missouri River.

Of the operations of the company in Nebraska during the coming season, Mr. F. W. D. Holbrook, Assistant Chief Engineer, writes that the company proposes to make surveys this winter and the coming spring, to ascertain the feasibility and expense of a railroad from Ashland, Saunders county, Nebraska, or its vicinity, up the Wahoo creek to a connection with the Union Pacific Railroad at some point not yet determined upon. Also, surveys from Crete, on the Big Blue, both north and south, in the valley of said river, making connection with the Union Pacific Railroad at Columbus. Also, a line will be surveyed from Lincoln to Seward. Surveys up the Wahoo will probably be started in about a week, the valley of this creek being so thickly settled as to allow of the surveyors dispensing with the usual camp outfit, and enabling them to make their reconnoisance with comparatively little discomfort, notwithstanding the time of year. Mr. D. H. Aimsworth will be in charge of the party making these surveys, and many of those who accompanied him in surveys this summer in the West will be with him.

Little Rock, Pine Bluff & New Orleans.

The Little Rock *Gazette* says : "The main line of this road runs from this place, *via* Pine Bluff, Monticello and Hamburg, to the Louisiana line. A branch of this road leaves Pine Bluff, striking the Mississippi River about eighty miles from that place. At present this is called the Chicora Branch of the Little Rock, Pine Bluff & New Orleans Railroad. Over sixty miles of this branch have been graded, the iron is laid down and cars running fourteen miles out from Chicora—crossties are on the next thirty miles, and a party of six hundred men are grading near Pine Bluff, having only fourteen miles to complete before reaching that city. It is expected to reach Pine Bluff in thirty days, and have the cars running over the entire branch line by the 4th of March.

"A corps of engineers has recently surveyed the main line from Pine Bluff to Monticello and Hamburg, and will soon be to the Louisiana line. This line has only been surveyed to within twelve miles of this place."

Mississippi, Ouachita & Red River.

From the Little Rock *Gazette* we learn that cars are already running out twenty miles from the Mississippi river, and will reach Monticello within a month. Grading is progressing on the first ten miles west of Monticello, and the timbers for the Saline river bridge are being made ready.

Detroit, Hillsdale & Indiana.

The track on this line is now completed from Ypsilanti to Hillsdale, the last rail having been laid on the 24th ult. Passenger and freight trains will commence running regularly over the line about the middle of this month. The length of line thus completed is about 60 miles. The chief stations are Ypsilanti, Saline, Manchester, Brooklyn and Hillsdale. Probably a line will be constructed from Brooklyn to a point west of Jackson on the Michigan Air Line after which the Michigan Central's through business will take this route—almost an air line from Detroit to Michigan City.

Evansville, Henderson & Nashville.

Mr. Hugh Pitcairn, Assistant Superintendent of this road, has sent to the Cincinnati Board of Trade the following statements :

"General Boyle, President of the Evansville, Henderson & Nashville Railroad, has directed me to say that he entertains no doubt that this road will be completed early in January, and that by the 1st of February next it will be opened for the receipt and shipment of freights. The equipment of the road will be small, but will be supplied as rapidly as the business shall demand.

"We confidently expect to compete successfully for all freights for Southern markets from your city and cities East and West.

"The connections of our road by rail and water with centres of trade and business bring us within competing distance with other Southern railroads, and it will doubtless be the policy of this road to avail itself of these advantages.

"In the event of any blockade of the Louisville & Nashville Railroad, or if their rates shall not be reasonably low, I believe this and connecting roads, and the river can successfully compete for the business of your shippers, going to Nashville and points south of that city.

"Distance from Cincinnati, *via* Ohio & Mississippi Railroad, and Evansville & Cincinnati, and Evansville, Henderson & Nashville railroads, to Nashville, 398 miles.

"Distance from Cincinnati, *via* Ohio & Mississippi Railroad and Louisville & Nashville Railroad, to Nashville, 312 miles.

"Distance from Cincinnati *via* Ohio River and Evansville, Henderson & Nashville Railroad to Nashville, 405 miles.

"Distance from Cincinnati *via* Indianapolis, Vincennes and Evansville, Henderson & Nashville railroads, to Nashville, 439 miles.

"Distance from Cincinnati *via* Ohio & Mississippi and Louisville & Nashville railroads to Memphis, 504 miles ; from Cincinnati *via* Ohio & Mississippi and Evansville, Henderson & Nashville railroads, 566 miles.

"These distances, which are proximately correct, show that our road, with its connections by rail and the Ohio River, can compete with other roads South for the business of your shippers."

Narrow Gauge in Pennsylvania.

A party of Pennsylvanians propose to construct a narrow gauge railroad from Allentown through Reading and Lebanon to Harrisburg, running along Swatara and Tulpehocken creeks. As there is already a rail road on this line which is not overworked, a failure in this instance might indicate a bad location as much as a deficiency in the gauge.

St. Louis, Belleville & Southern Illinois.

The following are the stations on this road, which was opened a few weeks ago. The figures show the distance of each station from East St. Louis : Belleville, 14 miles ; Freeburg, 22 miles ; New Athens, 28 miles ; Marissa, 37 miles ; Coulterville, 44 ; Pinckneyville, 61 miles ; Duquoin, 70 miles.

Laporte & Michigan City.

About half the iron is down on this road, and the line, which is about ten miles long, is to be completed by the end of the month. It connects the Chicago, Cincinnati & Louisville Railroad, now in operation from Laporte to Peru, Ind., with Lake Michigan.

Massachusetts Railroad Projects.

The following is nearly a complete list of the petitions, to come before the next Massachusetts Legislature, for new railroads or extensions of old ones:

For a railroad from Dunstable to Concord;

Of the Bedford Railroad corporation, for leave to extend its line northwardly to Lowell and southerly to Cambridge, there to connect with the Fitchburg Railroad;

For a railroad from Ashburnham to connect with any railroad in the vicinity;

For the incorporation of the Middlesex Central Railroad, direction and termini not stated;

For a railroad from Tyngsborough to the New Hampshire State line in Brookline;

Of the Stony Brook Railroad Company, for leave to extend its line from Groton to Fitchburg;

Of the Massachusetts Central Railroad Company, for the right to extend its line from the present authorized terminus in Weston to Boston;

Of the Connecticut River Railroad Company for the right to purchase or build a railroad from Northfield to White River Junction;

Of the same corporation for leave to build a branch from its Mount Tom station to Easthampton;

Of the New Bedford & Taunton Railroad Company for leave to extend its line, direction and limits not stated;

For a new railroad from Dunstable to Brookline, on the New Hampshire State line;

For the incorporation of a railroad company, to be known as the Lee & Hudson River Railroad Company;

For the incorporation of the Lynn & Marblehead Railroad Company, to connect the Marblehead branch of the Eastern Railroad with the main line of that company near the town line between Salem and Swampscott;

Of the Lancaster Railroad Company for leave to lease its line to some other company;

Of the Boston, Barre & Gardner Railroad Company for the right to extend its line to Winchendon;

For a new railroad from Bolton Centre to Worcester;

For a railroad from Princeton to Pratt's Junction;

Of the Vermont & Massachusetts Railroad Company, for the right to lease its line from Grout's Corner to Brattleborough;

For a railroad from Medfield to West Roxbury to unite with the Dedham Branch of the Boston & Providence Railroad Company;

For a new railroad from Watertown to Brighton;

For a railroad to connect Lancaster on the Worcester & Nashua road and Leominster on the Fitchburg road;

For a railroad from Plymouth to Sandwich;

For a railroad to connect the Woonsocket Branch of the Boston, Hartford & Erie Railroad in Needham with the Mansfield & Framingham Railroad in Sherborn.

St. Joseph & Denver.

The St. Joseph *Union* of the 1st inst. gives the following account of the progress of this road during the year 1870 and its present condition:

"To-night the iron rail will be laid into Marysville, the county seat of Marshall county, Kansas, 112 miles west. This makes seventy miles completed during the year, at an average cost of $18,000 per mile. The additions to the rolling stock have been five locomotives, fifty flat cars, twenty-two combination cars and ten hand cars, at a cost of $116,000. About $1,200,000 has been expended in construction, over $100,000 of which came from St. Joseph.

The passenger receipts now average about $1,000 per week. The amount of freight received at and sent over the road from this city foots up in the neighborhood of 14 000 tons. A depot will be opened at Marysville next week, when through business will commence. A telegraph line will be put up early in the sprng. The road is under contract to Fort Kearney, to be completed within eighteen months from the day it reaches Marysville."

European & North American.

The Lewistown *Journal* says as soon as the ice is of sufficient strength on the Mattawamkeag the wood work of the railway bridge will be strung across. Preparations are being pushed forward for pile driving on the line of the road. This is required on the Crosuntic stream, and also about a mile west of the Moluncus stream. A steam-shovel is to be set in operation immediately at the big cut near the Mattawamkeag bridge. This when got at work, will be at the cost of some $9,000.

Kansas City, St. Joseph & Council Bluffs.

Since the first of January, 1870, the road has been extended north from Maryville sixteen miles to the Iowa State line, at an average cost of $18,000 per mile, making the length of the branch sixty-one miles. The main line is 203 miles long. Station houses have been built at St. Joseph, Weston, McPaul's, Forbes, Barnard, Maryville, Worcester, and Bolckow, the first two being large anp handsome structures. That at the foot of Francis street, in St. Joseph, cost $7,500. The company have purchased 120 freight cars, four first class passenger coaches and two locomotives, and have put on their line the famous Pullman Palace cars, which run from Council Bluffs through to St. Louis and Quincy. From the terminus of the branch, at the Iowa State line, to a junction with the Burlington & Missouri River Railroad, in Iowa, is forty miles, and this gap will undoubtedly be closed during the present year. This done, the shortest route to Chicago will be *via* this road.

Besides the expenses enumerated above, the company has expended $300,000 in ballasting the track, building permanent bridges, &c., and has built a round house, turn-table, and water station at Council Bluffs, costing $30,000.—*St. Joseph Union, Jan.* 1.

ELECTIONS AND APPOINTMENTS.

—On the 27th inst., the directors of Michigan Lake Shore Railroad Company (Allegan to Muskegon), elected J. N. Converse, of Boston, President, and Joseph Fisk, of Allegan, Vice President.

—Thomas L. Courtney, of Richmond, has been appointed Purchasing Agent of the Richmond, Fredericksburg & Potomac Railroad.

—The St. Joseph Bridge Building Company has been organized at St. Joseph, Missouri, with the following gentlemen as incorporators: Willard P. Hall, Isaac C. Parker, James A. Matney, John Pinger, I. G. Kappner, J. B. Hinman, J. H. R. Cundiff, John L. Bittinger, O. M. Smith, J. D. McNeely, James B. Hawley, M. Oliver and William Z. Ransom.

—A company was organized at Bellevernon, Pa., on the 22d ult., for building the Bellevernon branch of the Pittsburgh & Connellsville Railroad. L. C. Baldwin, of the firm of John Gibson's Son & Co., Philadelphia, was elected President, and the following-named persons as directors: R. C. Schmertz, S. F. Jones, S. W. Powers, H. Lowry, James Moore, Samuel Shepler, C. P. Markle, John Rankin, M. P. O'Hern, W. O. Hughart, N. Q. Speer, D. B. H. Allen.

—The Directors of the Manhattan & Southern Railroad Company, organized for building a road from Manhattan, Kansas, south to a connection with the Missouri, Kansas & Texas road, have elected the following officers: H. G. Barner, President: N. Green, Vice President; L. R. Elliott, Secretary; Geo. W. Higginbotham, Treasurer. The Directors are: G. W. Higinbotham, E. B. Purcell, I. T. Goodnow, N. A. Adams, N. Green, L. R. Elliott, R. B. Spilman, John Hunter, M. J. Gove, H. G. Bemies, W. H. Bush, E. B. Smythe, and J. C. Peck.

—Mr. James Ball has been appointed Master Mechanic of the new Logansport shops of the Columbus, Chicago & Indiana Central Railway. He has been connected heretofore with the Baltimore & Ohio and the Central Ohio. There are about 80 locomotives under his care.

—Samuel L. Campbell has been appointed Purchasing Agent and Paymaster of Marietta & Cincinnati Railroad with headquarters at Cincinnati.

—Edward S. Scranton has been elected Secretary and Treasurer of the Shore Line Railroad Company of Connecticut, in place of W. T. Bartlett, resigned. His office will be in New York, with that of the New York & New Haven Company, which leases the Shore Line road.

—Mr. Beverly R. Keim, but a short time since appointed Assistant General Passenger Agent of the Union Pacific Railroad, resigned this position on the 3d instant to accept that of General Ticket Agent of the Kansas & Pacific Railway. It is probable that Mr. R. B. Gemmell, the late General Ticket Agent of the Kansas Pacific, will be a division Superintendent of that road.

MECHANICS AND ENGINEERING.

Sleighs for Horse Railroads.

The Lowell Horse Railroad has received two sleighs from Portland, Me., for use on their tracks, which are said to be far superior to the old ones in every particular. They are each twelve feet long by five and a half wide inside measurement. The runners are long, and the hind as well as the fore runners move on a pivot. The seat for the driver, instead of being on the top of the car as on the old sleighs, is elevated but a short distance above the floor of the car. The top of the car, front and rear, extends over the driver's seat and platform, the driver and conductor being sheltered in a measure in stormy weather. The use of these sleighs has been attended with much success in past seasons, and others are now building for this road.

Railroad Manufactures.

The Lewis Iron Company, of St. Louis, has closed a contract with the Missouri, Kansas & Texas Railroad for 500 freight cars, said to be the largest contract of the kind ever made in the West, amounting to nearly $400,000.

The machine shop of the Stonington Railroad Company, in Providence, destroyed by fire a few months since, has been rebuilt, and work has been begun in it.

LOCOMOTIVE STATISTICS.

Chicago, Rock Island & Pacific.

The following is the report furnished from the General Superintendent's office for the month of November:

ILLINOIS DIVISION.

The number of miles run by trains was as follows:

Passenger trains	33,364
Freight "	90,938
Miscellaneous "	15,043
Total number of miles run	141,340

The average cost per mile run was:

Fuel	8.12 cts.
Oil and waste	0.62 "
Repairs	6.82 "
Total	15.56 cts.
Engineers, firemen and wipers	7.16 "

Number of miles run to

Pint of oil	19.52
Ton of coal	39.62

IOWA DIVISIONS.

The number of miles run by trains was as follows:

Passenger trains	40,952
Freight "	92,999
Miscellaneous "	27,700
Total	161,651

The average cost per mile run was:

Fuel	7.81 cts.
Oil and waste	0.65 "
Repairs	5.62 "
Total	14.08 cts.
Engineers, firemen and wipers	7.44 "

Average number of miles run to

Pint of oil	18.19
Ton of coal	40.36

The whole number of locomotives owned by the company is 143, of which 72 are on the Iowa divisions and 71 are on the Illinois Division..

Two locomotives have been in the Chicago shops during the month, one in the Davenport shops, and one is engaged in construction on the Chicago & Southwestern Railroad.

Burlington & Missouri River.

Mr. George Chalender, Master Mechanic of the Company, makes the following report for the month of November, 1870:

Miles run by passenger trains	39,162
" " freight "	83,635
" " miscellaneous "	24,470
Total number of miles run	147,267

The average cost per mile was:

For repairs	5.84 cts.
" oil, waste and tallow	0.84 "
" fuel	9.19 "
" engineers, firemen and wipers	7.86 "
Total cost per mile run	23.73 cts.

The average number of miles run was:

To one ton of coal	37.53
" pint of oil	14.20

Coal is charged at $3.50 per ton. Fifty-two locomotives made mileage during the month, two were in shop most of the month, and one is rebuilding.

PERSONAL.

—Of Mr. W. H. Pettibone, who lately resigned the Assistant Superintendency of the Rockford, Rock Island & St. Louis Railroad, the Davenport *Gazette* says: "Commencing as a shoveler on the New York & Erie Railroad, he has by faithfulness merited and received promotion till he has reached near the topmost round of the railroad ladder. Prompt, energetic, industrious and courteous, Superintendent Pettibone has made a host of friends among the business men of this city and at points adjacent to the line of road, who will be pleased to hear of his success and good luck in the future."

—The employes in the New Haven Car Company's works at Newhallville, Conn., a few days ago presented to the Superintendent of the works, Mr. J. T. Leighton, a handsome gold chain and locket worth $150.

—By a recent decision of Judge Dobbin, of the Superior Court of Baltimore (the same who decided the State tax on passengers on the Baltimore & Ohio Railroad unconstitutional) the Baltimore & Ohio Company is directed to pay the dividend on $3,000,000 loaned to it by the State of Maryland in 1835 in gold. It has been paid in currency since the days of legal tender. The difference now is but $18,000 per year, but at times during the war it was more than $250,000.

RAILROAD GAZETTE

PUBLISHED EVERY SATURDAY.

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Editorial Announcements.

Correspondence.—We cordially invite the co-operation of the Railroad Public in affording us the material for a thorough and worthy Railroad paper. Railroad news, annual reports, notices of appointments, resignations, etc., and information concerning improvements will be gratefully received. We make it our business to inform the public concerning the progress of new lines, and are always glad to receive news of them.

Inventions.—Those who wish to make their inventions known to railroad men can have them fully described in the RAILROAD GAZETTE, *if not previously published,* FREE OF CHARGE. *They are invited to send us drawings or models and specifications. When engravings are necessary the inventor is expected to furnish his own engravings or to pay for them.*

Articles.—We desire articles relating to railroads, and, if acceptable, will pay liberally for them. Articles concerning railroad management, engineering, rolling stock and machinery, by men practically acquainted with these subjects, are especially desired.

Engineering and Mechanics.—Mr. M. N. Forney, Mechanical Engineer, whose office is at Room 7, No. 72 Broadway, New York, has been engaged as Associate Editor of this journal in charge of these departments. He is also authorized to act as our agent.

Removal.—About the tenth of January next the office of the Railroad Gazette will be removed to Nos. 110 *and* 112 *Madison Street.*

☞ *Our Prospectus and Business Notices will be found on the last page.*

GOV. PALMER ON RAILROAD RESTRICTIONS.

A considerable part of the message of Governor Palmer to the Legislature of this State is devoted to the consideration and recommendation of legislation concerning railroads. In this case the subject is forced upon the Governor, as the new constitution prescribes to the Legislature numerous duties in this respect, and compels it to do what heretofore was at best only permitted, not prescribed. The new constitution is mandatory in its provisions. It requires that all railroad companies doing business in the State shall have an office within the State where the names of all stockholders with the amount of stock held by each and a record of all transfers of stock, etc., shall be kept, and that these records shall be open to public inspection. It requires that a majority of the directors of any railroad company incorporated by the laws of this State shall be citizens of this State. It requires that 60 days' notice shall be given of any consolidation of two or more lines. It commands the Legislature to establish maximum rates for freight and passengers, saying "the "General Assembly shall from time to time pass laws "establishing reasonable maximum rates of charges "for the transportation of passengers and freight on "different railroads in this State." It forbids the issue of any stock or bonds, except such as represent money, labor or material received and applied, and then only upon giving sixty days' notice. It requires the Legislature to "pass laws to correct abuses and prevent "unjust discrimination and extortion in the rates of "freight and passenger tariffs on the different railroads "in this State, and enforce such laws by adequate pen- "alties to the extent, if necessary for that purpose, of "forfeiture of their property and franchises."

These are positive requirements. More is permitted, but so much is commanded. Certainly if the Legislature is to do all that is here prescribed it will need a great deal of good advice, and the governor is entirely justified in giving this subject special study and special prominence. It will need more care and study—and, we may add, more wisdom—to dispose of these subjects satisfactorily than is likely to be found in an average Legislature; and, indeed, it would tax the ability of the ablest assembly in the world to settle them fairly and justly.

Whatever may be thought of Governor Palmer's recommendations, it is evident that he has considered the subject with great care, understands the complexity of the questions to be dealt with and the extreme difficulty of establishing any uniform rule or set of rules for the restriction of the business of transportation on scores of lines, each differing from the other, recognizes the fact that there are certain rights which even constitutional conventions cannot abrogate, and conscientiously believes in the propriety and legality of the principles which he announces. So much at least, is greatly in his favor. Usually very little respect has been paid to or deserved by the recommendations of State executives concerning railroads, because they have been not merely crude and weak, but not even sincere. Too often they have been mere "buncombe," not intended to express convictions, state principles, or affect legislation, but to curry favor with the ignorant. Governor Palmer's message comes at a time when he might be expected to shape his recommendations so as to gain popular favor, and many, doubtless, will seek and pretend to find in it a bid for a seat in the United States Senate; but there is everywhere in these recommendations, even where most distasteful to the corporations, a total absence of appeals to popular prejudices and a sober statement of principles and of recommendations which are not like the work of a demagogue. Governor Palmer has given us an eminently respectable paper, really designed to affect legislation and very likely to do so. It therefore merits the fullest and freest criticism.

It is important to determine just how far the provisions of the new constitution extend to corporations organized under the old one. While they, like all others and like individuals, are subject to regulations which may be changed, there are certainly some rights given by charter which cannot be taken away except by fault of the corporation itself. Governor Palmer intimates this, but nowhere attempts to discriminate between those provisions of the constitutions applicable to all corporations and those affecting only those organized when they were part of the fundamental law. The restrictions and duties which the constitution imposes upon railroad corporations "must," he says, "of course be binding upon all here- "after created, and it (the constitution) also applies, in "important respects, to existing railway corporations "and must be enforced against them by appropriate "legislation." The final decision as to the effect of the provisions of the new constitution on old corporations must be made by the courts, it is true, but the Legislature must first pass laws in accordance with its interpretation, else the courts will have no cases to decide. Some legal advice would seem to be very appropriate before attempting such legislation. Under the new constitution it is to be hoped that the Legislature will pass laws in order that may be executed instead of the chapters of laws that cannot be enforced, such as have usually formed the railroad legislation of the State, and which seem very like an attempt to satisfy a popular demand for restrictions on corporations by mere sound and fury. Such legislation is, perhaps, quite as satisfactory as any to railroad corporations desiring to do pretty much as they please, but it cannot last forever, and it is very important that when effective laws are passed they should be intelligent and just.

The Governor expresses his opinion of the status of railroad corporations briefly as follows: "Railroads "are public highways, and the corporations and indi- "viduals that operate them are public carriers, and the "property interests of the proprietors of railways are "held by them subject to the right of the State to adopt "and enforce such regulations as will protect the pub- "lic from arbitrary exactions and unjust discrimina- "tions." He is convinced that competition is not a check on rates, showing, as we have done heretofore, that the advantages gained by competing points are paid for by stations less favorably situated, and that the expenses of conducting bussness are greatly increased by the struggles to obtain patronage.

As to the provisions of the constitution which require the Legislature to establish maximum rates of charges for transportation, the Governor makes no recommendations, but simply quotes the section as defining clearly the duty of the Legislature.

We believe that in this message we have the first distinct recognition of the fact that the owners of railroads have rights and that the State owes them protection. If all our state legislatures had remembered this and had passed efficient laws securing stock and bond-holders in the possession of their property, and enabling them at all times to understand its condition and control its management, many millions of dollars would be saved to the country, and the cost of transportation would be sensibly less. There is no country where railroads honestly and economically constructed and operated offer better or more certain returns than in this, and especially in the West. We should, therefore, be able to obtain capital for their construction readily and at low rates. But we believe that there is scarcely a civilized country where so high a rate of interest is demanded on railroad bonds, while capitalists rarely venture to take stock in a new railroad as an investment, unless they are in position personally to manage the affairs of the company. Examples of the absolute stealing of railroads from the hands of the rightful owners and the diversion of their earnings to the personal uses of their managers have been the great disgrace of our country, and though these abuses have not been so great in this State, it is wise to provide against them.

Although the Governor is confident of the power of the Legislature to provide the regulations and restrictions recommended and enforce them, he recognizes that there are serious difficulties arising from the complex nature of the subject. "There are conflicting in- "terests to be reconciled and adjusted, and nothing "within the sphere of governmental action requires "more delicacy of management than what is termed the "railway problem." This is the rock on which legislation splits. So complicated is the subject that there seems to be no practicable mean between the broad statement of certain general limitations and the management and operation of the railroads directly by the State. It will be easier for the Legislature to establish the retail price of sugar and other groceries at the various towns in the State than to fix absolutely the rates of transportation. It is so complex a task that it may be called impracticable. Any such plan, even if it is supported by the courts, is likely to fail of the main object aimed at, that is, a general lessening of the cost of transportation.

Anticipating that the railroad companies and warehouse proprietors will deny the legality of some of the restrictions imposed, the Governor recommends that the duty of enforcing them be entrusted to a board of commissioners.

This is a matter of great importance. But a board of railroad commissioners, if we are to have one, should have other duties than the fighting of corporations. It should be their duty to settle this difficult and complicated railroad problem, of which the Governor speaks, to collect, compare and collate the statistics of companies in this State, and, as far as possible, of those in other States and countries. They should furnish the facts on which legislation should be based,—should in fact, indicate legislation. It is not possible for every member of the Legislature to understand the subject thoroughly. Those even who are thoroughly familiar with railroad business and have studied for many years its relations to the community will hardly recommend any restrictive regulations as anything more than tentative measures. If we are to have anything better than the crude and ineffective legislation of the past, we must have it prepared by men who thoroughly understand the subject. The members of the proposed rail road commission, some of them at least, should be men thoroughly familiar with the operation of railroads. The State cannot afford to blunder in its legislation for a long series of years for want of the knowledge and experience which railroad men alone possess.

Having thus lightly touched upon the leading points of the Governor's recommendations, we leave the more critical consideration of each to another time.

The Portage, Winnebago & Superior and Manitowoc & Minnesota Railroads.

These two Wisconsin companies, within a short time to be consolidated, hold charters for lines running from Manitowoc, on Lake Michigan, a little north of west across the State to Prescott, on the Mississippi river, near St. Paul; also from Portage City north, crossing the Manitowoc line at Stevens' Point, near the center of the State, and continuing on to Ashland and Superior City, with possibly a line to Bayfield. This last

mentioned line has a grant of 1,500,000 acres of land, authorized by act of Congress in 1866 for a road from Portage City, Berlin, Doty's Island or Fond du Lac to Bayfield and Superior. This grant was conferred by the State Legislature in 1869 upon the Portage & Lake Superior and the Winnebago & Lake Superior companies, which have since been consolidated under the first named title.

The towns on the line between Doty's Island and Stevens' Point have voted aid to the amount of $5,000 per mile, and it is expected that other towns between Manitowoc and Stevens' Point will be as liberal. Mr. E. B. Phillips, lately President of the Lake Shore & Michigan Southern Railway Company, together with Mr. Colby, son of Gardner Colby, of Boston, have taken the contract for building these roads, from which it may reasonably be inferred that the construction will not long be delayed, and that Chicago will soon have another connection with the Northern Pacific road, and also, by way of Stevens' Point, with St. Paul.

Transcontinental Travel.

We have received from Mr. T. H. Goodman, General Passenger and Ticket Agent of the Central Pacific Railroad, a number of posters of that company intended for use in China, Japan, Australia and New Zealand. These posters have a neat map of a hemisphere upon them, showing the entire Western Continent, Western Europe and Asia, Eastern Asia, and Australia. This permits one to trace all the Pacific transportation lines and their connections with Europe. It resembles somewhat the excellent poster of the Rock Island Company, which gave the Northern Hemisphere, but has a different field, and is especially adapted to show the connections with Australia and New Zealand, which of course do not appear on a map of the Northern Hemisphere. But the posters are most interesting as indicating the close connections which have been estab. lished with the Orient, for they are actually used in soliciting business in Asia and Australia. One announces "quick time and cheap fares from "China and Japan to New York and Liverpool," and "through ticket orders to the United States, Canada "and Europe for sale at the several agencies of the "Pacific Mail Steamship Company throughout Japan, "China and India;" the other makes a similar announcement for New Zealand and Australia, ticket orders being for sale at the American Steamship Line agencies.

The Central Pacific Company, Mr. Goodman informs us, has an agent representing its interests in Australasia, and has made arrangements with the various railroad and steamship companies by which travelers may be ticketed across the entire hemisphere—more than half way around the world—represented on the maps, which forms the insignia of the company and is printed on its letter-heads, etc., as well as on its posters and circulars.

Chicago Railroad News.

Chicago, Rock Island & Pacific.

At the Rock Island depot on the 5th inst. there was an arrival of 32 car loads of tea from San Francisco, consigned to parties in New York. There also arrives over this road 6 to 8 car loads of silver ore daily from the Rocky Mountains, consigned to parties in New York and Boston.

January 4 a car load of valuable sheep was shipped from the stock yards by this road for parties in San Francisco.

The "In Freight" of this road has been moved into the new quarters, corner of Fourth avenue and Twelfth street.

A New Appointment.

Mr. C. N. Pratt, very widely known as the General Agent of the National Land Company, and for some time past agent of the North Missouri Railroad in this city, has been appointed General Agent of the Hannibal & St. Joseph Railroad in this city. Mr. Pratt has been for seventeen years a railroad agent, and for most of that time has had special charge of immigrant business. For eleven years he was connected with the Chicago & Alton Railroad, during the war having charge of military transportation, immigration having ceased at that time and the military traffic forming a large share of the business of the road.

In 1867 Mr. Pratt became connected with the Kansas Pacific Railway with special charge of its immigrant business. He had already considerable experience in Kansas colonization through his connection with the New England Aid Society in the early days of the Territory. His experience in the transportation of immigrants had acquainted him with their wants, and he had certain peculiar views concerning the proper management of immigration which he now sought to put in practice. The Kansas Pacific Company then had a vast landed property and a railroad almost without business, the territory through which it ran being almost uninhabited for a great part of the distance. It was most essential to the success of the company to encourage the settlement of the country along its line, first to give the road a traffic, and second to enhance the value of its land. Mr. Pratt conceived the idea of establishing a corporation especially for the encouragement of immigration, the transportation and protection of immigrants, and the sale of land. In accordance with these ideas the National Land Company was organized in 1868, and to it was intrusted the sale of the lands of the Kansas Pacific and the Denver Pacific roads. This company has been a great success. It has put into practice one of Mr. Pratt's favorite plans, *i. e.*, the encouragement of immigration by colonies. The success they have had in this has been noticeable, and abundantly proves the advantages of the plan. It has settled one English, one Scotch, one French, two Welch, two German, four Scandinavian and four American colonies in Kansas and Colorado, which are already prosperous communities, with many of the advantages and comforts of older countries, where but a few months ago was an almost unbroken wilderness. In most cases the colonies consist chiefly of neighbors and friends, who have found in their new homes a strange country, but a familiar community—their old habits, customs, language, churches and social institutions. It has been the transportation of their old life to a new field, and not the commencement of an entirely new and strange life, which to all but the very young is a shock not easily borne.

The work done by this company is of especial importance to this city, as it adds continually to the field of its trade. Chicago has become one of the great immigrant forwarding stations and depots, and is one of the chief points of operation of the National Land Company. Remaining connected with this land company at this point, Mr. Pratt has found that he can work to better advantage in connection with a railroad which has close connections with Chicago. As heretofore, he will pay especial attention to the immigrant business over the line, for which his position and his experience give him special qualifications.

Chicago & Alton.

The company's earnings for the month of December were:

1870	$386,598 84
1869	340,850 93
Increase (13.4 per cent.)	$45,747 91

The following shows the aggregate receipts from the operating department for the year, compared with those of 1869:

From passengers	$1,286,305 26
From freight	3,303,782 39
From miscellaneous	241,652 15
Total for 1870	$4,831,739 80
Total for 1869	4,681,592 81
Increase (3.2 per cent.)	$150,174 99

This is an increase of about $30,000 over the amount set down for December in the Superintendent's late statement for the year, in which the last months' earnings were estimated.

Michigan Central.

The company will next week take possession of their new short line between Jackson and Niles—The Michigan Air Line—and will run cars over it, as well as over the old road, attached to the mail train which leaves this city at 5:40 a. m.; also, attached to the Kalamazoo accommodation which departs at 4:10 p. m., will be a car which will run over the new line as far as Three Rivers. The local freight trains will also run over this line. The road is one of the best and probably the best ever constructed in the State, but it is intended to wait until the road bed is thoroughly settled before putting the heavy traffic on it.

As an evidence that affection is possible for a railroad line, the following from Dr. Miller, of the Omaha *Herald*, is noticeable. After announcing the completion of the line and saying that through passenger trains would run over it, the editor asks to be excused. "We shall 'stick' to the good old "route. It is sanctified to us by seventeen years riding over "it, and none of your new-fangled notions and schemes for "beating any other road to New York shall cheat us of our "first love." He wouldn't feel at home on the Michigan Central "without the familiar shouts of conductors and brake-"men announcing 'Niles,' 'Battle Creek,' 'Jackson,' 'Kala-"mazoo,' 'Ann Arbor,' etc. We know the Air Line will "beat all other routes to New York, but we propose to fight "it out on the old one." It is noticeable, by the way, that when the new line is completed by a connection from the Air Line to the Ypsilanti & Hillsdale road, all the large towns of the old road in Michigan except Niles and Ypsilanti will be off the through line.

Proposed Legislation Affecting Illinois Railroad Corporations.

The following is the part of the annual message of Governor Palmer, of Illinois, respecting railroad corporations:

The constitutional prohibition of special laws for the creation of railroad corporations makes it necessary that a general law should be adopted, at this session of the general assembly, for the organization and government of that most useful and necessary class of associations. The constitution imposes restrictions and duties upon railway corporations that must, of course, be binding upon all hereafter created, and it also applies, in important respects, to existing railway corporations, and must be enforced against them by appropriate legislation.

Every railway corporation organized or doing business in this State, under the laws or authority thereof, must maintain an office in this State for the transaction of its business, where transfers of stock must be made, and in which shall be kept for public inspection, books in which shall be recorded the amount of capital stock subscribed and other matters in relation to their organization and business that it is important to the public interests should be known; and shall also report to th auditor of public accounts, or to an officer to be designated by law, all their acts and doings, to such extent as may be prescribed by law. This provision of the constitution comprehends all railway corporations that do business in this State, whether they are organized under its laws or tolerated by its comity, and it is the duty of the general assembly, imposed by the 9th section of the 11th article of the constitution, to enforce the obedience of all by the passage of laws with suitable penalties. The 9th section of the 11th article of the constitution, and the 11th, 12th, 13th, 14th, and 15th sections of the same article, sufficiently indicates the purpose of the people that railroad corporations shall hereafter be subject to the control of law.

The usefulness of railways, and the extent of their beneficial influence upon the well-being and prosperity of the country, are not denied, and, indeed, considerations of that character are in no sense involved in a discussion of the extent to which it is judicious and proper to subject their management to legal control. Railroads are public highways, and the corporations and individuals that operate them are public carriers, and the property interests of the proprietors of rail ways are held by them subject to the right of the Stat to adopt and enforce such regulations as will protec the public from arbitrary exactions and unjust discriminations.

But the duty and the power of the State to interefere for the effectual control of railway corporations is disputed. Those who deny the necessity of interference insist that all the evils of excessive tariffs and unjust discrimination in rates for transportation will be ultimately corrected by the competition of different lines of railways, in their efforts to control business. Competition is far more expensive than direct methods of legal control. The greatest oppressions that burden the people grow out of the fierce and exhausting railway competition at important points, where their interests come in conflict; and one of the strongest reasons for the interference of the legislature to control the management of railway lines is that the burdens of the useless competition of different lines is thrown upon intermediate points where competition is impossible. Deprive railroad corporations of the power to impose discretionary rates upon their traffic, and the business community would suffer far less from the selfish contests of competing lines that in their effect unsettle values, to the confusion of business and the disappointment of the most prudent commercial calculations.

The denial that the State has the power, acting through the appropriate department, as determined by its constitution, to control the management of railway corporations and to regulate the rates imposed by them as public common carriers, so as to prevent extortion, oppression, favoritism and unjust discriminations against or in favor of localities and individuals—or to investigate their management and prevent the employment of the vast sums of money under their control for purposes of corruption—is to assert that a power has grown up in the State greates than the State itself, and makes an issue that the representatives of a free people cannot, without the most palpable disregard of their duty, evade.

"The General Assembly shall, from time to time, pass laws establishing reasonable maximum rates of charges for the transportation of passengers and freights on the different railroads of the State," and "the General Assembly shall pass laws to correct abuses and prevent unjust discriminations and extortion in the rates of freight and passenger tariffs on the different railroads in the State, and enforce such laws by adequate penalties, to the extent, if necessary for that purpose, of forfeiture of their property and franchises," are the clear and precise injunctions of the constitution, that at once answer all objections to the existence of the power, enjoin the duty and determine the department of the Government by which it is to be discharged

It is also proper for me to say, in this connection, that in the adoption of the 9th section of the 11th article of the constitution, and the 15th section of the same, the framers of that instrument intended that the General Assembly should go much further in the direction of the efficient control of the management of railway corporations than merely to pass laws establishing reasonable maximum rates of charges for the transportation of freight and passengers, and to correct abuses and prevent unjust discriminations in the rates of freight and passenger tariffs. It was, no doubt, the purpose of authors of the constitution, that the Legislature should pass laws that will give to the stockolders in railway corporations more complete control over their property, to prevent the fraudulent transfer of the stock of such corporation, to secure to stockholders and the public the means for a thorough investigation of their management, to prevent wrongful combinations to defraud stockholders and oppress the public, and to prevent the employment of the money of such corporations to influence legislation, or for other corrupt purposes.

But whether railway corporations are considered in the light of mere owners of property, that are entitled to the same favorable consideration that is accorded to all others, or as the managers of highways that penetrate into almost every county in the State, and that from their superior utility will soon supersede all others, or as the almost exclusive carriers of products of the industry of the whole State, or as legally organized aggregations of vast wealth, that from its form admits of indefinite combinations for the attainment of objects of common interest, or that they constitute the most powerful and active element that now exists under our form of government, every thoughtful man will confess the extreme difficulty of digesting an efficient, and at the same time just, system of laws for their government.

But the difficulties that occur to my mind do not relat to the power of the State to enact and enforce proper laws, but they grow out of the complex nature of the subject. There are conflicting interests to be re-

conciled and adjusted, and nothing within the sphere of governmental action requires more delicacy of management than what is termed the railway problem. And there is another ground upon which there is some degree of hesitation. There is no concealing the fact that of late years less confidence is felt by many in the powers of the State governments alone to subject railway management to the degree of control that every candid person must admit to be demanded by the interests of the people, and attention has been directed to the government of the United States as being alone equal to to the great duty of the hour. In my inaugural address, I thought it proper to say that "one of the most unhappy results of the great contest through which the nation has passed, is the confusion produced in the public mind as to the relative powers of the national and State governments," and my more extended experience has added force to the conviction that one of the worst evils that can exist in a free government is that there should be any serious difference of opinion either as to the extent or the distribution of its important powers.

If, as maintained by some, the Government of the United States has the power to create incorporations and authorize them to construct railways in the States, or to govern or control those created by the State authority, the resistance of the power ought to be no longer disputed, and steps should be taken to amend the Constitution of the United States so as to prohibit Congress from creating such corporations by special laws, and from granting the public property or extending the aid of the United States to private individuals or corporations, and, in short, to subject the Government of the United States to all the restrictions and limitations for the protection of public and private rights that are found in the most advanced and perfect constitutions of the States, and also to require of Congress to adopt such effective positive legislation as will subject existing and future railway management to proper control.

To those who assert the power in question for the Congress of the United States, the immediate necessity for thus amending the Federal Constitution will be apparent, for as the people of the States improve their constitutions, and subject railroad corporations to more efficient and complete control, this powerful interest will defeat all their labors by taking shelter under the authority of Federal laws, and the scenes of corruption that have been witnessed elsewhere, and that are now happily impossible in this and some other States, will be reproduced in Washington, aggravated by the fact that franchises conferred by the United States will be far more valuable than can be conferred by any of the States; that there are thousands of millions of public property to tempt the corrupt and the greedy; and that members of Congress, being far removed from the observation of their constituents, will betray the people without fear of popular indignation.

If, however, the opinions of the framers of the constitution, and the eminent statesmen who have actually guided the policy of the Government from its origin, are to be regarded as authority in the determination of the question under consideration, it ought not to be claimed that it is within the power of the Federal Congress to authorize the construction of railways in the States, or to create incorporations for that purpose, or to regulate or control existing railway corporations in any way whatever, and the General Assembly should earnestly protest against such an assumption of power by Congress, and proceed with a firm and unyielding step to the enactment of such just and constitutional laws for the proper government of railway corporatious, as may be necessary for the protection of the rights of the people of the State.

My apology for the extended discussion of this question is, that the people of the State, in the adoption of the amended constitution, have imposed upon the General Assembly duties of the highest importance, and doubts as to the power of the State to control the subject of railways have had and will have the effect to produce timidity, hesitation and feebleness in its councils. To maintain the usefulness of the State Governments, it must be established that their powers are in no sense subordinate or dependent, but that, under our political system, the grasp of the States upon their own proper functions is as firm and uncontrollable as that of the United States; that each are essential parts of our admirable political system, and their orbits in that system being defined, they are each supreme and alike indestructible.

The enforcement of the 13th article of the constitution is of but little less importance than the proper regulation of railways, and, indeed, the interests and duties of the managers of public warehouses and of railways are so intimately related that legislation relating to one would not be complete unless it included the other. Warehouse men are, like carriers, engaged in a public employment, and are, independent of the constitution, subject to legal control, and the principal effect of the constitutional provision is to remove all doubt as to the actual state of the law upon the points embraced, to render it unchangeable, and to impose upon the General Assembly the duty of passing laws to give it full effect. It will be proper, in my judgmetn, to provide for parties injured by the failure of warehousemen and railways to comply with the duties required by the constitution and such laws as may be enacted, cheap and simple remedies, and also to subject them to indictment. Experience has shown that private individuals are unwilling, and often unable, to encounter the expense of legal contests with these powerful interests, and as their duties are to the public, as well as to individuals, it seems eminently proper that the public should enforce them.

And the magnitude of the task that will be assumed by the State, in attempting to subject railways and warehouses, and the individuals and corporations that own, operaate and manage them, to that degree of legal regulation and control that is demanded by the public interests, render it necessary to create a Board of Commissioners, to whom the duty of correcting such laws as may be enacted for that purpose may be confided, and the Commissioners should be clothed with all the needful power, when the occasion demands it, to compel submission to the authority of the State.

Locomotive Improvement.

We have in two articles already published,* explained, firstly, in what respect the locomotive engine boiler is defective, and, secondly, we have indicated the principles which must be observed by those who attempt to improve upon it. It is now our task to show more precisely than we have yet done how these principles are to be applied in practice. Let us see what is the specific nature of the duty which that combination of fire-box, tubes and shell, known as the locomotive boiler, is expected to perform.

Engineers, as a rule, express the nature of this duty in very few words enunciating one simple idea: "A locomotive engine boiler, like any other boiler, is expected to convert a given weight of water per hour into steam." This answer is "simple" in more senses than one. It refers to a process which really comes the last in a chain of events or phenomena—which the reader will—and it takes no cognisance of the very complex action which actually goes on within not the locomotive boiler only, but every boiler. A locomotive is expected to evaporate, let us say, 200 cubic feet, or 12,500 lb., of water per hour. Let us suppose that this water is thrown into the boiler by the feed pump at a temperature of 60 deg.—the injector will introduce it at a far higher temperature, of course, but we may neglect this fact for the present—Now we have at the fire-box end of the boiler a temperature of at least 2,000 deg., and at the smoke-box end a temperature of at least 600 deg., and in approximate contact with all the heating surface, water at a temperature of say, 350 deg. In order to produce effective ebullition, it may be taken as proved that the temperature of the plate with which the water is in contact must be 80 deg. greater than that of the water. Ebullition, or more strictly speaking evaporation, will of course take place at a less difference of temperature than this; but the process of converting water into steam will not proceed with sufficient velocity to satisfy the requirements of the railway engineer with a less difference. If we add 80 deg. and 350 deg. we have a resulting temperature of 431 deg., which is the least at which it is possible to discharge the products of combustion from the boiler under existing conditions. The boiler pressure is here assumed to be 135 lb. above the atmosphere, a pressure frequently exceeded in modern practice. The difference between 430 deg. and 600 deg. is 170 deg.; and this is none too much when we consider that 600 deg. represents, not the temperature of the gases in contact with the tubes, but the average heat of the whole column of gas in each and all the tubes, and that this superflous heat is the surplus energy, so to speak, required to raise the metal of the tube 80 deg. above the temperature of the water which is supposed to be in contact with it, and to overcome the resistance of the soot with which the tube is lined. Bearing these things in mind, it is easy to see that no mere extension of surface by lengthening the tubes and reducing their diameter, can do much good so long as the temperature of the substance to be heated—water—remains as high as it must, under existing practice, necessarily be. If we were to ask any engineer whether the temperature in the smoke-box will or will not remain unaltered as the temperature of the water rises, he would simply laugh at us, and point out that when the fire is first lighted and the water is yet cold, the temperature in the smoke-box and smoke-box ends of the tubes is so low that the hydrogen proceeding from the coal and combining with oxygen, instead of being converted into steam, is condensed, and trickles down in the shape of streams of water from the end of each tube. Under these conditions the boiler is working to its maximum efficiency. There is no steam to drive the water away from the tubes on the one hand, and, on the other, the temperature at the smoke-box ends of the tubes need not be much more than 60 deg.—the temperature of the water—plus 80 deg. to overcome the thermal resistance of the plates, &c. If we add 100 deg. for the resistance of soot, and so on, we still have a smoke-box temperature of $60 + 80 + 100 = 240$ deg. only. Is there any good reason why this should not be the maximum temperature reached in the smoke-boxes of locomotives? None whatever, if proper arrangements are adopted. Of course, if we retain water at 350 deg. in contact with every atom of heating surface in the boiler, we cannot expect to cool down the escaping products of combustion below $350 + 80 + x$. In this formula x represents some co-efficient, the value of which will vary with the cleanliness of the tubes, the diameter, and the rate at which the gases traverse the flues; but we may assume it from practice to be at least 170 deg. We have, therefore, as the smoke-box temperature $350 + 80 + 170 = 600$. When the fire is forced, as in the case of an engine hauling a heavy load and nearly in full gear, the smoke-box temperature may reach as much as 1,100 deg.—first, but the velocity of the gases is increased; and, secondly, because the heating surface inside the boiler is no longer in contact with water, but with a mixture of steam and water. Under such circumstances, indeed, we may have as much ns 5 in. of "false water" in the glass gauge, showing plainly what is going on within the boiler. All this results from the present erroneous practice of surrounding every portion of the heating surface with water of the same temperature; and, secondly from permitting steam to be formed between the tubes and in contact with the heating surface. Those of our readers who have followed us so far will readily comprehend the nature of the remedies which we propose for adoption. We cannot in this place enter into details; every engineer will work these out as seems best in his own eyes. We shall only deal with general principles. Let us see what an improved locomotive boiler would be like.

There are two ways in which the principles, the nature of which we have indicated, may be applied. According to the first and simplest—the second we shall describe in a future article—the boiler would remain in all its principal characteristics unaltered. We still retain the fire-box, shell, and flues. The alterations consist in dividing the boiler into three distinct sections by transverse plates, traversed by the tubes, which could be made tight in them by suitable expanding mandrils. The transverse plates would strengthen the boiler, and add very little to its weight or price. We should then have three distinct boilers, so to speak, all heated by the one furnace. The precise position of the two extra tube plates is a point which it would require some experiment to settle properly, but we may suppose that a boiler barrel 10ft. long would be equally divided into three compartments, each 3ft- 4in. long. Over the central compartment would be fixed a steam dome, and from this compartment all the steam required by the engine would be drawn. The other two compartments would be kept quite full of water under all circumstances. Beginning with the front, or smoke-box, compartment, we find that this would be traversed by tubes containing gases at a comparatively low temperature. The quantity of heat which could be taken up from them by water at 350 deg. would be very small indeed. But they would not be brought into contact with water at any such temperature. On the contrary, the feed pumps would deliver into this compartment at the extreme forward end. The water would run under and over diaphragm plates, so as gradually to find its way back to the opening, through which, well heated, it would enter the central compartment. The maximum temperature of the feed would not, in practice, exceed 200 deg. If feed pumps are used the average temperature would not exceed 60 deg. If the temperature in the last couple of feet of the flues were 600 deg., it follows that even with a feed temperature of 200 deg. the smoke-box temperature should not exceed 400 deg.; while with feed water supplied at the lower temperature we have named, it should not exceed 310 deg. We might thus save from 150 deg. to 200 deg. of waste heat from an enormous volume of gas. We need not fear but that the surface in the leading compartment would be sufficient to enable the feed to take up all the spare heat corresponding with our calculations. No steam would be produced in this section of the boiler, and, therefore, "solid" water would always be in contact with the tubes, and their efficiency would, accordingly, be augmented.

The fire-box compartment would communicate with the central compartment, either through a small orifice in the upper part, controlled by a valve worked from the outside of the boiler, or by a differential automatic valve so constructed that in all cases a greater pressure would be maintained in the fire-box compartment than in any other portion of the boiler. What this difference of pressure should be would depend on circumstances, as we shall show in a moment. The object in view in maintaining the extra pressure is, of course, to prevent ebullition; in other words, the formation of steam in the fire-box compartment, the whole duty of which must be restricted to heating water. The compartment would be put in communication with the middle compartment, not only by the before-mentioned valve, but by suitable pipes and a pair of circulating pumps, worked off the cross-heads, or by eccentrics. These pumps would continually draw the water from the central compartment and force it into the fire-box compartment. As much water as they forced it would return stored with heat to the central compartment through the loaded valve. The pressure in the central being less than that in the fire-box compartment, a portion of the water so returned would at once flash into steam of this lower pressure; the remaining water would fall down, to be again pumped back at the temperature due to the lower pressure, to the fire-box compartment, the quantity lost by evaporation being, of course, made up by the feed coming in at, say 212 deg. or so from the smoke-box compartment.

In order to determine the size of the circulating pumps—a matter of some importance—we must know, among other things, the temperature in the fire-box and central compartments. Suppose the pressure in the latter to be 150 lb., including the atmosphere; the temperature corresponding to this pressure is 350 deg.; the total heat of water and steam at this pressure is 1,188.7 deg., of which the steam contains 866.5 deg. Let us further assume that the pressure in the fire-box compartment is 200 lb. on the square inch, corresponding to a temperature of 381.7 deg. Every pound of the water heated under this pressure and suffered to expand, so to speak, to the lower pressure of the central compartment, will give up the difference in heat existing between these compartments and proper to the two pressures; therefore, under the stated conditions, we shall have available for the conversion of a portion of each pound of water into steam 31.7, say 32 units of heat. But steam of 185 lb. pressure contains 866.5 units of heat per pound, and $\frac{866.5}{32} = 26.8$, say, in round numbers, 27. Consequently 1-27th of the whole volume of water passing in any given time, say a minute or an hour, from the fire-box compartment to the central compartment, would flashed into steam. But the bulk of the work of evaporation is supposed to be done in the fire-box compartment, which must therefore receive, not only nearly all the feed, but twenty-six times as much water. Therefore the circulating pumps must be able to throw twenty-seven times as much water as the feed pumps. If they throw less, then, under the conditions stated, steam will be formed in the fire-box compartment. In other words, the compartment would not be kept sufficiently cool; but this is just the defect we want to avoid. If we suppose the ordinary full-stroke feed pump to have a cross section of plunger equal to 3 square inches, or that, in other words, it is a shade less

* [Pages 292 and 317 of the RAILROAD GAZETTE.

than 2 in. diameter, then the plungers of the circulating pumps must be a little over 10 in. diameter, and the power expended in working them may be calculated thus, as compared with that expended in working the ordinary feed pumps: The circulating pumps would have an area of 81 square inches, which, multipled by 50 lb.—the difference in pressure between the two compartments—gives a gross resistance of 4,050 lb. The ordinary feed pump, with 3 square inches of area, must work against a pressure of 135 lb., or a gross resistance of 405 lb., therefore the work done by the circulating pumps would amount to ten times that assumed to be done by the feed pumps. But it must be borne in mind that these calculations are based altogether on the size of the ordinary feed pumps, which are usually so proportioned that to keep the boiler fully supplied they need not be at work more than half time. We may consequently, as the circulating pumps are always at work, assume that, instead of each circulating pump having twenty-seven times the capacity of each feed pump, fourteen times would be ample. The work expended in feeding the boiler of a locomotive cannot greatly exceed $\frac{1}{150}$th part of the whole power exerted, or, say, 2-horse power in an engine exerting 300-horse power. The work, under the conditions we have named, expended in producing circulation would therefore be about 10-horse power, or something like 3⅓ per cent. only. But a large proportion of this would probably be returned, in accordance with the well-known law that power is expended in the mere mechanical work done by steam bubbles in forcing their way to the surface through a body of water, most of which would be saved by the system of evaporation proposed.*

If we are content to reduce the size of the fire-box compartment so that one-half only of the whole work of evaporation would be done there, and the other half by the central compartment, then the power required to work the circulating pumps may be reduced to less than 2 per cent. of the gross power exerted by the engine. There are various reasons, again, why it might be found better to maintain the higher pressure in the central compartment, so that about three-fourths of the entire evaporation would be done in the ordinary way in the fire-box compartment, where there are no tubes, and the remainder done by the tubes kept in contact with solid water only. The central compartment would then deliver into the fire-box compartment. This is a matter of detail which does not materially affect the principle involved, but it shows that the power required to work the circulating pumps may be reduced to a very insignificant amount.

The advantages to be secured by such modification of the locomotive boiler are: First, that its external features would remain unchanged. Secondly, that little complication would be introduced. Many engines now running have both feed pumps and injectors. The injectors might under the new system be retained to supply feed water to the smoke-box compartment, the feed pumps being replaced by circulating pumps. Thirdly, that portion of the boiler in which the temperature of the products of combustion was highest would contain the hottest water, while, *per contra*, the smoke-box compartment would contain the coldest water. Fourthly, the duties of the fire-box end of the boiler being restricted in the fullest sense to the heating of water, no escaping bubbles of steam would ever interfere to prevent that contact between the water and the metal, which is essential to the effectual absorption of heat. Fifthly, the cost of the modifications which are proposed would be small. Sixthly, for very obvious reasons, it is probable that priming would be completely done away with.

So far as we are aware, although circulating pumps have been used by Benson and others, the boiler, the characteristics of which we have thus hastily sketched, is completely novel and unpatented, and any locomotive engineer can try it as soon as he pleases, without fear of infringing any man's rights. We believe that the principles on which our propositions are based are indisputably sound, and that the improved boiler would be found in practice to dispose of most of the objections now urged against locomotive boilers. One objection can be brought against the scheme, which is that the deposit question is not dealt with. We have reason to think, however, that most of the deposit would be found in the first and second compartments, and little or none at the fire-box end. In a succeeding article, however, we propose to show how the deposit question can be permanently settled. Meantime, it will suffice to say that, in such a boiler as we propose. the tubes might in part be spaced but one-fourth of an inch apart, without fear of the surfaces being rendered bare of water by the presence of steam which could not get away.—*The Engineer.*

* If this point be worked out in another way a very simple calculation will show that the power required to pump fourteen times 200 cubic feet—the volume of water supposed to be evaporated per hour by an engine working up to 300-horse power—that is to say, 2,800 cubic feet per hour, against a pressure of 50 lb. on the square inch, is but a fraction over 10-horse power indicated.

Common Carriers Cannot Contract Against Liability for Ordinary Care.

The following is the opinion of Judge Gregory in the case of the Michigan Southern & Northern Indiana Railroad Company *vs.* Heaton, (31 Ind., 397,) so far as the question of "Special Contract" is concerned, as reported in the *American Railroad Journal:*

It was with great reluctance that the courts of several of our American States at last yielded their assent to the proposition that the strict and severe responsibility which the common law imposes upon a common carrier could be limited by special contract. The Camden & Amboy R. R. Co. *vs.* Baldauf, 16 Penn. St. 67; N. J. Steam Nav. Co. *vs.* Merchants Bank, 6 How. U. S. 344; Atwood *vs.* Beliance Transp. Co. 9 Watts, 87. And this regret will be more deeply felt as the business of transporting goods passes more and more into the hands of extensive corporations, controlling vast capital, and, by combination with each other, virtually destroying competition. The shipper will not be in a position to contract with them on equal terms—he must submit to oppressive conditions, if they choose to impose them, or fail to procure the carriage of his merchandise to market. But if the general question is not now open, and has been so fully settled by judicial decision that the rule *stare decisis* is absolutely controlling, and a remedy is called for by the great public interests of commerce, it must be sought in legislation. We have, however, not now to do with that question necessarily, and we do not propose to ourselves its decision at present.

The language in the contract in the case before us is capable of a very broad construction. It would do no violence to its words, to say that it was intended to exempt the carrier from liability for loss by fire or accident, though such fire or accident were the result of the grossest carelessness on the part of the carrier, but the appellant concedes that such a construction cannot be sustained, for the reason that gross carelessness, under the circumstances, would be fraud, and a contract whereby a party stipulates for immunity for his own fraud is against public policy and will not therefore be tolerated. But why would gross carelessness be fraud? It is the absence of the slightest care. Why should it be fraud, if the parties have contracted for exemption from all care, and have adjusted the compensation accordingly? Shall the carrier be compelled to exercise some degree of care, though he is to receive no compensation for it, and the property has been put into his warehouse upon an express agreement that he need not trouble himself about it at all? Must he do more than he has contracted to do, and more than he is paid for doing, to avoid the imputation of fraud? Nay, is fraud ever predicated of a transaction where a contract fairly entered into has been fully and scrupulously performed according to the very intention of both parties to it, and according to its letter? It seems to us that the reason why a carrier may not, because of public policy, stipulate for his own gross carelessness, is a different one, and does not necessarily involve the idea of fraud. The law has a tender care for great public interests, pecuniary as well as moral, and in many cases will hold contracts void because they are plainly in contravention of the public welfare in mere business aspect. Trade and commerce are objects of this fostering care. Hence a contract never to carry on a particular business, however ample the consideration, is illegal and void. It injuriously affects the public, by depriving it of men's services in departments in which they may be most useful, it discourages industry and enterprise, diminishes the products of ingenuity and skill, prevents competition. enhances prices, and exposes the community to all the evils of monopoly. Alger *vs.* Thatcher 19 Pick. 51. But there is no element of fraud in it. And there are other classes of contracts, not needful now to be enumerated, also held illegal and void as being against public policy, merely because their performance would tend to affect injuriously important interests of society. Contracts in general restraint of marriage, and marriage brokerage contracts may be mentioned as examples. Now the shipper puts his goods in the custody of the carrier, and thereby excludes himself from all opportunity to care for their safety until the transit is terminated. If the carrier do not guard them against spoilage, damage, or destruction, the goods are subject to multiplied hazards; the perils of transportation become a most serious check to the great interests of commerce; and interchanges of commodities between distant sections are rendered precarious and uncertain. Transportation generally, without any care by the carrier for the safety of the goods, would be a tax upon the industry of the country impossible to be estimated. If adopted and maintained as a rule, in a country of such large extent and diversified production as ours, it would ruinously diminish the home value of such of the fruits of industry as must be sent to distant markets, and greatly enhance it to the ultimate consumer, thus operating to the serious detriment of both. But the consequences to the community need not be further dwelt upon. It may be enough to say, that none of the great corporations engaged in the carriage of goods to market would perhaps be willing to publish to shippers, that it is a fact that they give no care whatever to avoid the loss, by fire or accident, of goods confided to them for shipment. It would injuriously effect the business of any one of them, if believed by shippers. Traffic would seek other channels, if others claimed to bestow reasonable care for the safety of their cargoes; nor would low tariffs be deemed enough to induce the exposure of goods to so many probabilities of destruction. It is not quite true, then, that the contract between the shipper and the carrier concerns only themselves, as has sometimes been assumed; it does affect also great public interests most seriously and vitally, and therein rests a reason entirely satisfactory to us, for the conclusion, that the parties are not at liberty to make such a contract as they please.

There is still another reason why, in such a contract, a general exemption of the carrier from the consequences of gross negligence should be held void. Some care on the part of the carrier is absolutely essential to the performance of the contract in any reasonable sense. Property cannot take care of itself; the carrier, during the transit, has exclusive custody and control of it, and he only has the right to give that attention to it without which the chances of its loss and destruction are so imminent that it is not fair to assume that it would have been shipped at all. A condition that no care, or anything less than reasonable care, shall be bestowed upon it, is therefore repugnant to the general intention of the contract and should be rejected.

Indeed it was once supposed to be a proposition not liable to be controverted, that a common carrier was, in his relations to society, somewhat different from a private party—that he exercised a sort of public employment, was bound to carry all goods offered for reasonable compensation, and that the law imposed upon him his duties and responsibilities as incident to the character voluntarily assumed. We have seen that the American Courts, following those of England, have in many quarters evinced a reluctant tendency wholly to disregard this ancient doctrine. Here there has been a fortunate hesitancy and doubt evincing a purpose to refuse to sanction such stipulated exemptions from the carriers' common low liability as would repair the reasonable efficiency of the contract for shipment and thus defeat its purpose. To dispense with the duty of exercising at least ordinary care for the safety of the goods, would, it is plain, have this effect; and this court upon the fullest consideration of the subject, finds itself free from all doubt that a condition so repugnant to the general and chief purpose plainly intended by the contract is void, and must be disregarded. The doctrine is elementary and of universal application. The contract for shipment necessarily implies that the carrier shall use some measure of diligence to deliver the goods at the place of their destination. Slight care—the least measure of diligence—is not reasonably sufficient to preserve valuable merchandise from the depredation of thieves, or from destruction by the elements. The plain purpose of the contract of shipment is to secure the safe transportation and delivery of the goods, and it surely is equally plain that a provision in it that the carrier need not make a reasonable effort to accomplish that purpose—such an effort as men of ordinary prudence would make if engaged in transporting their own goods—is destructive to this purpose and intent. And it has accordingly been held, that such a provision, however broad in its term, has only the effect of reducing the liability for negligence of a common carrier to that of a private carrier for hire, who is bound to the use of ordinary care. So the rule was declared by the Supreme Court of the United States, in the N. J. Steam Nav. Co. *vs.* Merchants' Bank 6 How. 344, the leading American case sustaining such special contracts. It was only the "extraordinary duties annexed to the employment" which it was there held might be dispensed with by special contract. The language of the agreement was of the most comprehensive character, expressly declaring that the goods should "be at all times at the exclusive risk" of the shipper, and the carrier "will not in any event be responsible for the loss of any goods." And yet the court held this language: "The owner by entering into the contract virtually agrees that in respect to the particular transaction the carrier is not to be regarded as in the exercise of his public employment, but as a private person who incurs no responsibility beyond that of an ordinary bailee for hire, and answerable only for misconduct or negligence." And again, "we think it would be going further than the intent of the parties, upon any fair and reasonable construction of the agreement, were we to regard it as stipulating for wilful misconduct, gross negligence, or want of ordinary care," &c. And such was stated to be the result of the English cases. The effect of the case is, that general language, however comprehensive, and however plainly it may declare a purpose to exempt the carrier from every possible risk incident to shipment shall nevertheless not be understood to include the losses resulting from want of his reasonable care. We know not upon what principle such a construction of the contract in that case could be maintained, save that which we have stated above. See also Lyon *vs.* Wells, 5 East 28. In Wild *vs.* Pickford, 8 M. & W. 442, the contract pleaded provided against the carriers' liability unless the goods were insured according to their value, and paid for at the time of delivery, which had not been done. The question arose upon a demurrer to the plea, and the court, upon a review of the cases, held that the carrier was liable for ordinary negligence, notwithstanding the contract. The court, per Parke, B., said "But still he undertakes to carry from one place to another, and for some reward in respect to carriage, and is therefore bound to use ordinary care in the custody of the goods. See also Hinton *vs.* Dibbin 2 Q. B. 646, Story on Bailm, § 571; Thomas *vs.* Boston & Prov. R. R. 10 Metc. 472; Penn. R. R. Co. *vs.* McCloskey 23 Penn, St. 526, Powell *vs.* Pa. R. R. 32 id. 414, Welsh *vs.* P., F. W. & C. R. R. Co. 10 Ohio St. 66. Citations might be multiplied: but we choose to rest our decision of the case before us quite as much on principle as upon the decided cases. The latter are not uniform, and are incapable of reconciliation. It will be seen from the cases cited, that whether the negligence of the carrier be gross or ordinary, does not in such a case effect the question of liability.

—The earnings of the Milwaukee & St. Paul Railroad were $95,307.18 for the third week of December. This gives a decrease for the week of $26,207,93 as against last year, and a decrease of $23,762.15 for the three weeks; while the year from January 1 to date shows an increase of $213,438.52.

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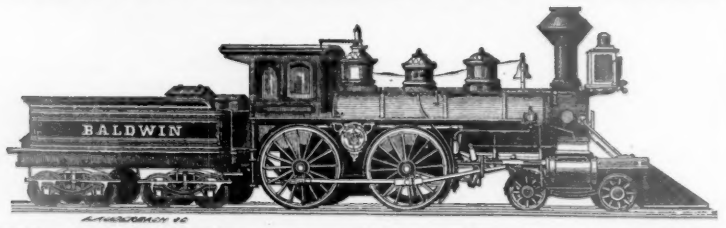

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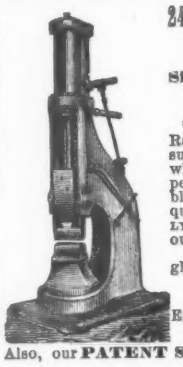

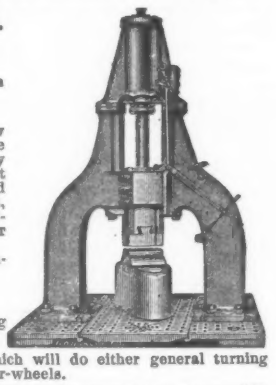

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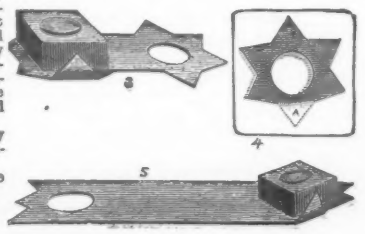

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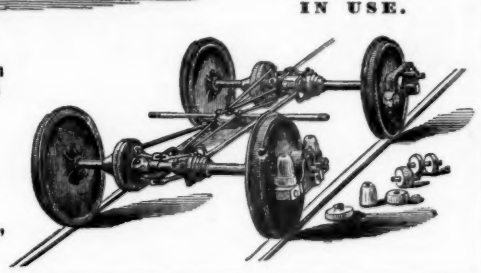

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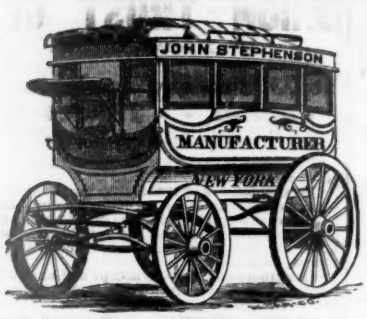

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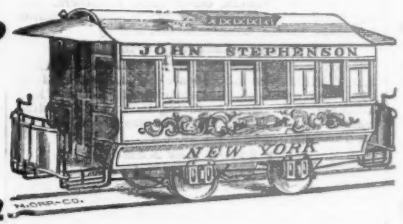

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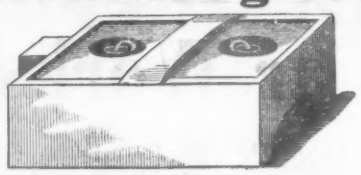
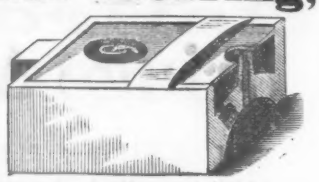


1.



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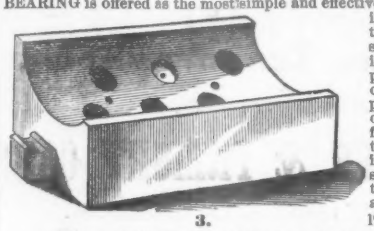

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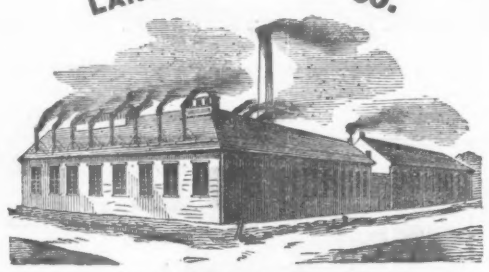

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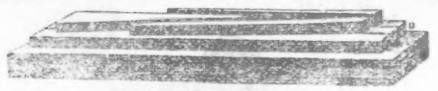

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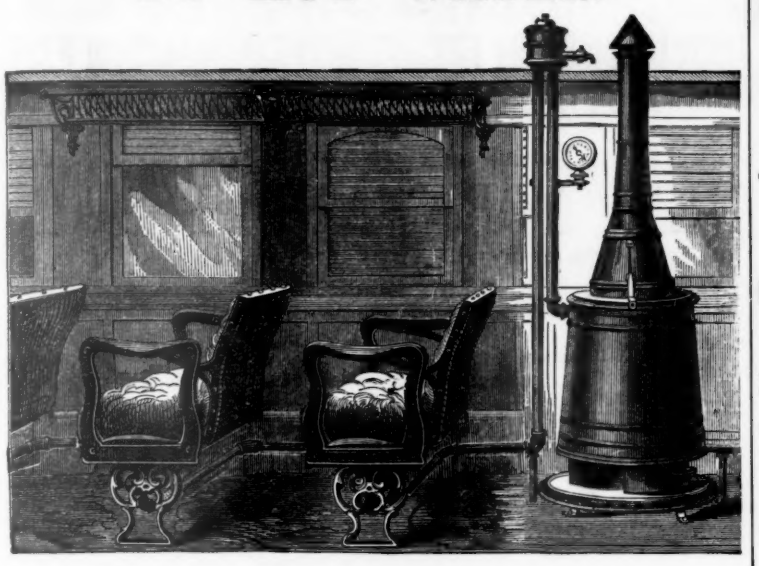

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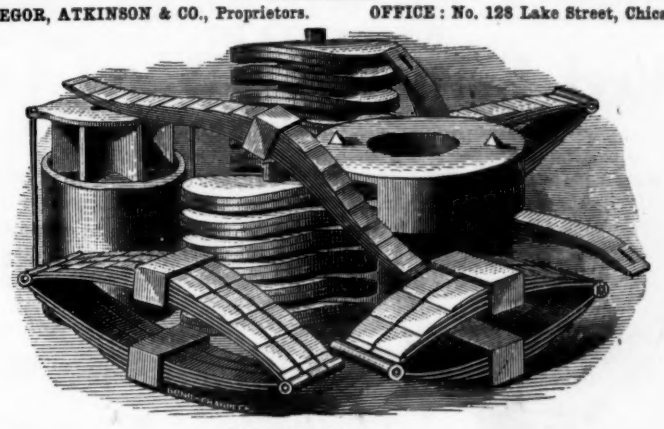

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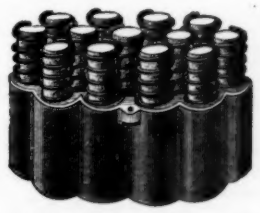

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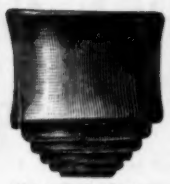
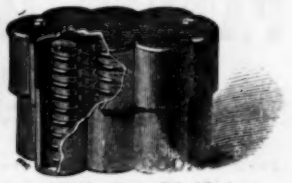
"Dinsmore" Spring.



Volute Buffer Spring.



Group Rubber Center Spiral Spring.

No. 1 Barclay St., NEW YORK. | No. 15 La Salle St., CHICAGO.

WORKS ON 129th AND 130th STREETS, NEW YORK.

GENERAL FREIGHT DEPARTMENT.

The Illinois Central Railroad

ARE PREPARED TO TAKE FREIGHT FOR

Cairo, St. Louis, Peoria,

BLOOMINGTON, SPRINGFIELD, JACKSONVILLE,

And All Points in the Central and Southern parts of the State;

MOBILE & NEW ORLEANS BY RAIL OR RIVER

And ALL POINTS on the MISSISSIPPI below CAIRO. Also, to

Freeport, Galena and Dubuque.

☞ Freight Forwarded with Promptness and Despatch, and Rates at all times as LOW as by any other Route.

BY THE COMPLETION OF THE BRIDGE AT DUNLEITH,

THEY ARE ENABLED TO TAKE FREIGHT TO ALL POINTS WEST OF DUBUQUE ☞ WITHOUT CHANGE OF CARS! ☜

DELIVER FREIGHT IN CHICAGO ONLY at the FREIGHT DEPOT of the Company, foot of South Water St. Parties ordering Goods from the East should have the packages marked:

"Via Illinois Central Railroad."

For THROUGH BILLS OF LADING, and further information, apply to the LOCAL FREIGHT AGENT at Chicago, or to the undersigned.

M. HUGHITT, Gen. Supt. J. F. TUCKER, Gen. Freight Agt.

MOORE

Steel Elastic Car Wheel Co.

OF NEW JERSEY.

Proprietors of

MOORE'S PATENT

FOR THE MANUFACTURE OF

ELASTIC CAR WHEELS,

FOR PASSENGER AND SLEEPING COACHES.

Noiseless, Safe, Durable and Economical.

Also, Manufacturers of

CAR WHEELS OF EVERY DESCRIPTION.

H. W. MOORE, President.
JAS. K. FROTHINGHAM, Secretary.
F. W. BLOODGOOD, Treasurer.

Works, cor. Green and Wayne Sts., JERSEY CITY, N. J.
P. O. Address—Box 129, Jersey City, N. J.

American Compound Telegraph Wire.

More than 3000 Miles now in Operation,

Demonstrating beyond question its superior working capacity, and great ability to withstand the elements. For RAILROAD LINES, connecting a single wire with a large number of Stations, and for long circuits, this wire is peculiarly adapted; the large conducting capacity secured by the copper, with other advantages, rendering such lines fully serviceable during the heaviest rains.

Having a core of steel, a small number of poles only are required, as compared with iron wire construction, thereby preventing much loss of the current from escape and very materially reducing cost of maintenance OFFICE AMERICAN COMPOUND TELEGRAPH WIRE CO.
234 West 29th Street, New York.

BLISS, TILLOTSON & CO., Western Agents,
247 South Water Street, Chicago.

Charles J. Pusey,

78 & 80 BROADWAY, NEW YORK.

American and English Rails,

LOCOMOTIVES AND CARS FISH-PLATES, SPIKES, &c.

— SOLE AGENT FOR —

Atkins Brothers' Pottsville Rolling Mills, and G. Buchanan & Co., of London.

☞ Special attention given to filling orders for small T and STREET RAILS, of every weight and pattern. P. O. Address—Box 5222.

OLD RAILS BOUGHT OR RE-ROLLED, AS DESIRED.

J. E. FRENCH. W. S. DODGE. D. W. CROSS.

Winslow Car Roofing Company.

PATENT IRON CAR ROOFS.

Established, 1859.

No. 211 Superior St. **CLEVELAND, O.**

Over 20,000 Cars covered with this Roof! We claim that these Roofs will keep Cars dry, and will last as long as the Cars they cover without any extra expense after once put on.

☞ SEND FOR CIRCULARS.

THE

"RED LINE!"

—RUNNING OVER THE—

Michigan Southern and Lake Shore R. R.'s,

—WAS THE—

FIRST LINE to CARRY FREIGHT BETWEEN the EAST and WEST,

WITHOUT CHANGE OF CARS!

CARS RUN THROUGH TO

NEW YORK AND BOSTON,

IN FOUR AND FIVE DAYS!

☞ Contracts made at the Offices of the Line. ☜

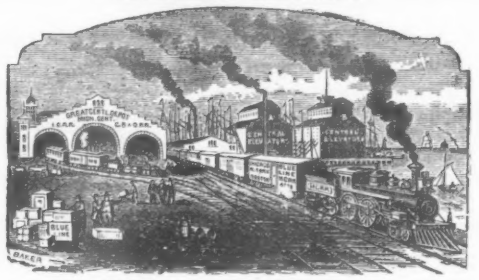
C. Shutter, Agent, 247 Broadway, New York. A. Cushman, Agent, Old State House, Boston, Mass

W. D. MANCHESTER, Agent, 54 Clark St., Chicago.

Great Central Route.

"BLUE LINE."

ORGANIZED JANUARY 1, 1867.

1870.  1870.

OWNED AND OPERATED BY THE

Michigan Central, Illinois Central, Chicago, Burlington & Quincy, Chicago & Alton, Great Western (of Canada), New York Central, Hudson River, Boston & Albany, and Providence and Worcester Railroads.

THE "BLUE LINE" is the only route that offers to shippers of freight the advantages of an unbroken gauge through from Chicago to the Seaboard, and to all Interior Points on the line of Eastern Connections beyond Suspension Bridge and Buffalo. All Through Freight is then transported between the most distant points of the roads in interest.

WITHOUT CHANGE OF CARS!

The immense freight equipment of all the roads in interest is employed, as occasion requires, for the through service of this Line, and has of late been largely increased. This Line is now prepared to extend facilities for the transit and delivery of all kinds of freight in Quicker Time and in Better Order than ever before.

The Blue Line Cars

are all of a solid, uniform build, thus largely lessening the chances of delay from the use of cars of a mixed construction, and the consequent difficulty of repairs, while remote from their own roads. The Blue Line is operated by the railroad companies who own it, without the intervention of intermediate parties between the Roads or Line and the public.

Trains run through with regularity IN FOUR OR FIVE DAYS to and from New York and Boston. Especial care given to the Safe and Quick Transport of Property Liable to Breakage or Injury, and to all **Perishable Freight.**

Claims for overcharges, loss or damage, promptly settled upon their merits. Be particular and direct all shipments to be marked and consigned *via*

"BLUE LINE."

☞ *FREIGHT CONTRACTS* given at the offices of the company in Chicago, New York and Boston.

J. D. HAYES, GEN. MANAGER,.. Detroit.

C. E. NOBLE,..... } 349 Broadway, N. Y. | P. K. RANDALL, 69 Washington St., Boston.
GEO. E. JARVIS,... } | W. W. STREET,.....91 Lake St., Chicago.
N. D. MUNSON,.....Quincy, Ill. | J. JOHNSON,.....Cairo, Ill.

THOS. HOOPS, GEN. FR'T AGT. Michigan Central Railroad, Chicago.
A. WALLINGFORD, AGT. M. C. & G. W. R. R., No. 91 Lake St., Chicago.
N. A. SKINNER, Freight Agent Michigan Central Railroad.

Empire Line.

THE EMPIRE TRANSPORTATION COMPANY'S

Fast Freight Line to the East

—AND—

TO THE COAL AND OIL REGIONS,

Via Michigan Southern, Lake Shore, and Philadelphia & Erie R. R.'s,

WITHOUT TRANSFER!

Office, No. 72 LaSalle Street, Chicago.

GEO. W. RISTINE, Western Superintendent, Cleveland, Ohio.

W. G. Van Demark,..265 Broadway, New York. | E. L. O'Donnell,.....Baltimore, Md.
G. B. McCulloh,....42 South 5th St., Philadelphia. | Wm. F. Smith,.....Erie, Penn

JOHN WHITTAKER, Pier 14 North River, New York.

JOSEPH STOCKTON, Agent, Chicago.

W. T. HANCOCK, Contracting Agent.
WM. F. GRIFFITTS, Jr., Gen. Freight Agent, Philadelphia.

CHICAGO & NORTHWESTERN R. W.

Comprising the PRINCIPAL RAILROADS from CHICAGO Directly NORTH NORTH-WEST and WEST.

ALL RAIL TO THE PACIFIC OCEAN!

Great California Line.

TRAINS LEAVE WELLS STREET DEPOT AS FOLLOWS:

8:30 A. M. Cedar Rapids Pass | **10:15 P. M. Night Mail.**
10:45 A. M. Pacific Express. | **10:15 P. M. Rock Island Pass.**
10:45 A. M. Rock Island Exp. | **4:00 P. M. Dixon Passenger.**

For Sterling, Rock Island, Fulton, Clinton, Cedar Rapids, Boone, Denison, Missouri Valley Junction, Sioux City, Council Bluffs and Omaha, there connecting with the

UNION PACIFIC R. R.

For Cheyenne, Denver, Ogden, Salt Lake, the White Pine Silver Mines, Sacramento, San Francisco, and all parts of Nebraska, Colorado, New Mexico, Arizona, Wyoming, Montana, Idaho, Utah, Nevada, and the PACIFIC COAST.

FROM CHICAGO	Hours.	1st Class Fare.	FROM CHICAGO	Days.	1st Class Fare.
To OMAHA,.....	23	$20.00	To SACRAMENTO,.	4½	$118.00
" DENVER,.....	52	70.75	" SAN FRANCISCO,	5	118.00

TRAINS ARRIVE:—Night Mail, 7.00 a. m.; Dixon Passenger, 11.10 a. m.; Pacific Express 4:15 p. m.; Rock Island Express, 4:15 p. m.; Cedar Rapids Passenger, 6:45 p. m.

FREEPORT LINE.

9.00 A. M. & 9.45 P. M. For Belvidere, Rockford, Freeport, Galena, Dunleith, and St. Paul.

4.00 P. M., Rockford Accommodation.
5.30 P. M., Geneva and Elgin Accommodation
6.10 P. M., Lombard Accommodation.
5:50 P. M., Junction Passenger.

TRAINS ARRIVE:—Freeport Passenger, 2:30 a. m., 3:00 p. m.; Rockford Accommodation, 11:10 a. m.; Geneva and Elgin Accommodation, 8:45 a. m.; Junction Passenger, 8:10 a. m.; Lombard Accommodation, 6:50 a. m.

WISCONSIN DIVISION.

☞ Trains leave Depot, cor. West Water and Kinzie Sts., daily, Sundays excepted, as follows:

10.00 A. M. **DAY EXPRESS,** for Janesville, Monroe, Whitewater, Madison, Prairie du Chien, Watertown, Minnesota Junction, Portage City, Sparta, La Crosse, St. Paul, and ALL POINTS ON THE UPPER MISSISSIPPI RIVER; Ripon, Berlin, Fond du Lac, Oshkosh, Neenah, Appleton, and Green Bay.

3.00 P. M., Janesville Accommodation.

6.00 P. M. **NIGHT EXPRESS,** for Madison, Prairie du Chien, Watertown, Minnesota Junction, Portage City, Sparta, La Crosse, St. Paul, and ALL POINTS ON THE UPPER MISSISSIPPI RIVER; Ripon, Berlin, Fond du Lac, Oshkosh, Menasha, Appleton, Green Bay, and THE LAKE SUPERIOR COUNTRY.

5.00 P. M., Woodstock Accommodation.
6:20 P. M., Barrington Passenger.

TRAINS ARRIVE:—5:30 a. m., 7:45 a. m., 10:10 a. m., 1:00 p. m. and 7:15 p. m.

MILWAUKEE DIVISION.

MILWAUKEE MAIL,		8:15 A. M.
EXPRESS, (ex. Sun.) Waukegan, Kenosha, Racine and Milwaukee,.....	9:45 A. M.	5:00 P. M.
EVANSTON PASSENGER,		1:00 P. M.
HIGHLAND PARK PASSENGER,		1:15 P. M.
MILWAUKEE ACCOMMODATION, with Sleeping Car attached.....		11:00 P. M.
EVANSTON ACCOMMODATION, (Daily,) from Wisconsin Div. Depot.....		6:15 P. M.
KENOSHA ACCOMMODATION, (Sundays excepted) from Wells St. Depot.....		4:10 P. M.
AFTERNOON PASSENGER, from Milwaukee Div. Depot.....		5:45 P. M.
WAUKEGAN ACCOMMODATION, (except Sundays) from Wells St. Depot.....		5:25 P. M.
WAUKEGAN PASSENGER, (Sundays excepted) from Wells St. Depot.....		5:00 P. M.

TRAINS ARRIVE:—Night Accommodation, with Sleeping Car, 5:00 a. m.; Day Express, 4:10 p. m. Milwaukee Mail, 10:10 a. m.; Afternoon Passenger, 8:00 p. m.; Waukegan Accommodation, 8:25 a. m.; Kenosha Accommodation, 9:10 a.m.; Evanston Accommodations, 1.40 and 4.00 p. m.; Waukegan Passenger, 7:55 a. m.; Highland Park Passenger, 3.45 p. m.

PULLMAN PALACE CARS ON ALL NIGHT TRAINS.

THROUGH TICKETS Can be purchased at all principal Railroad Offices East and South, and in Chicago at the Southeast corner of Lake and Clark Streets, and at the Passenger Stations as above.

H. P. STANWOOD, Gen. Ticket Agt.
GEO. L. DUNLAP, Gen'l Supt.

Milwaukee & St. Paul R. W.

THE ONLY ALL RAIL LINE TO

ST. PAUL AND MINNEAPOLIS!

AND ALL PORTIONS OF

Wisconsin, Minnesota & Northern Iowa.

PURCHASE TICKETS VIA MILWAUKEE.

Passengers Going via Milwaukee,

Have Choice of Seats in Clean Coaches, and on Night Trains, a full night's rest in Palace Sleeping Cars.

☞ BAGGAGE CHECKED THROUGH BY THIS ROUTE ONLY! ☜

PASSENGERS FROM CHICAGO can obtain these Advantages only by the MILWAUKEE DIVISION of the CHICAGO & NORTHWESTERN R'Y.

SPECIAL NOTICE.—Passengers destined to any place in Wisconsin, Minnesota, or Northern Iowa, either on or off the Lines of this Company, who cannot procure Through Tickets to their destination, should purchase their Tickets **TO MILWAUKEE,** as this is the Great Distributing Point for these States.

A. V. H. CARPENTER, Gen. Pass. Agt. Milwaukee.
S. S. MERRILL, Gen. Manager, Milwaukee.

CHICAGO, ROCK ISLAND & PACIFIC RAILROAD.

☞ THE DIRECT ROUTE FOR ☜

JOLIET, MORRIS, OTTAWA, LASALLE, PERU, HENRY, PEORIA,
Lacon, Geneseo, Moline,

ROCK ISLAND, DAVENPORT,

Muscatine, Washington, Iowa City,
GRINNELL, NEWTON, DES MOINES,

COUNCIL BLUFFS & OMAHA!

CONNECTING WITH TRAINS ON THE UNION PACIFIC RAILROAD, FOR

Cheyenne, Denver, Central City, Ogden, Salt Lake, White Pine, Helena, Sacramento, San Francisco,

And Points in Upper and Lower California; and with Ocean Steamers at San Francisco, for all Points in **China, Japan, Sandwich Islands, Oregon and Alaska.**

☞ TRAINS LEAVE their Splendid new Depot, on VanBuren Street, Chicago, as follows:

	LEAVE.	ARRIVE.
PACIFIC EXPRESS, (Sunday excepted).....	10.00 a. m.	4.15 p. m.
PERU ACCOMMODATION, (Sundays excepted).....	4.30 p. m.	9.45 a. m.
PACIFIC EXPRESS, (Saturdays excepted,).....	10.00 p. m.	[Mon. ex. 7.00 a. m.

ELEGANT PALACE SLEEPING COACHES!

Run Through to Peoria and Council Bluffs, Without Change.

☞ Connections at LA SALLE, with Illinois Central Railroad, North and South; at PEORIA, with Peoria, Pekin & Jacksonville Railroad, for Pekin, Virginia, &c.; at PORT BYRON JUNCTION, for Hampton, LeClaire, and Port Byron; at ROCK ISLAND, with Packets North and South on the Mississippi River.

☞ **For Through Tickets,** and all desired information in regard to Rates, Routes, etc., call at the Company's Offices, No. 37 South Clark Street, Chicago, or 257 Broadway, New York.

A. M. SMITH, Gen. Pass. Agent. **HUGH RIDDLE,** Gen. Supt. **P. A. HALL,** Asst. Gen. Supt.

KANSAS PACIFIC RAILWAY.

Great Smoky Hill Route

THROUGH **KANSAS** TO **DENVER,** COLORADO,

Connecting with the DENVER PACIFIC R. R. for CHEYENNE; forming, in connection with the UNION and CENTRAL PACIFIC R. R.'s, a NEW ALL-RAIL ROUTE to

Colorado, Wyoming, Utah, Montana, NEVADA, CALIFORNIA,

AND THE PACIFIC COAST.

THE ONLY ROUTE RUNNING PULLMAN DRAWING-ROOM & SLEEPING CARS THROUGH TO DENVER.
☞ **No Omnibus or Ferry Transfer!** ☜

☞ Direct Connections made in UNION DEPOTS at **Kansas City** [State Line.] with the Hannibal & St. Joseph, North Missouri and Missouri Pacific Railroads.

☞ Daily Trains leave Kansas City, State Line and Leavenworth, for Lawrence, Topeka, Emporia, Humboldt, New Chicago, Chetopa, Junction City, Abilene, Salina, Brookville, Ellsworth, Hays, KIT CARSON, DENVER, GREELEY, CHEYENNE, OGDEN, SALT LAKE CITY, CORINNE,

Sacramento & San Francisco.

☞ Connect at Kit Carson with Southern Overland Passenger and Mail Coaches for PUEBLO, TRINIDAD, SANTA FE, and all principal points in

Old and New Mexico and Arizona.

☞ Connect at DENVER with the Colorado Central Railroad and Fast Concord Coaches, for Golden City, Black Hawk, Central City, Idaho City, Georgetown and Fair Play.

Passenger and Freight Rates as low and conveniences as ample as by any Route.

Ask for Tickets via KANSAS PACIFIC RAILWAY, which can be obtained at all principal ticket offices in the United States.

R. B. GEMMELL, Gen. Ticket Agt. Lawrence, Kansas.
T. F. OAKES, Gen. Freight Agt. Kansas City, Mo.
A. ANDERSON, Gen. Sup't. Lawrence, Kan.

FARMS AND HOMES IN KANSAS.

Five Million Acres of Choice Farming Lands, situated along the line of this Great National Route, at from one to six dollars per acre. For full particulars, apply to **JNO. P. DEVEREUX,** Land Commissioner, Lawrence, Kan.

THE ERIE & PACIFIC DISPATCH CO.

Are Authorized Freight Agents.

For information, Contracts, and Bills of Lading, apply at their office, 64 Clark Street, Chicago.

H. H. RAPP, AGT.

Western Union Railroad.

CHICAGO & NORTHWESTERN DEPOT, CHICAGO. | MILWAUKEE & CHICAGO DEPOT, MILWAUKEE.

THE DIRECT ROUTE!

CHICAGO, RACINE & MILWAUKEE,

— TO —

Beloit, Savanna, Clinton, Pt. Byron, Davenport, Mineral Point, Madison, Freeport, Fulton, Lyons, Rock Island, Sabula, Galena, Dubuque, Des Moines, Council Bluffs,

OMAHA, SAN FRANCISCO

AND ALL PRINCIPAL POINTS IN

Southern and Central Wisconsin, Northern Illinois, and Central and Northern Iowa.

FRED. WILD, Gen. Ticket Agent.
D. A. OLIN, Gen. Superintendent

THE FAVORITE THROUGH PASSENGER ROUTE!

Chicago, Burlington & Quincy
RAILROAD LINE.

3 THROUGH EXPRESS TRAINS DAILY!

FROM CHICAGO	Hours.	1st Class Fare.	FROM CHICAGO	Days.	1st Class Fare.
TO OMAHA, - - -	23	$20.00	TO DENVER, - -	2½	$63.00
" ST. JOSEPH, - -	21	19.50	" SACRAMENTO, -	4½	118.00
" KANSAS CITY, -	22	20.00	" SAN FRANCISCO,	5	118.00

TRAINS LEAVE CHICAGO from the Great Central Depot, foot of Lake Street, as follows:

BURLINGTON, KEOKUK, COUNCIL BLUFFS & OMAHA LINE

7:40 A. M. MAIL AND EXPRESS, (Except Sunday,) stopping at all stations; making close connections at Mendota with Illinois Central for Amboy, Dixon, Freeport, Galena, Dunleith, Dubuque, LaSalle, El Paso, Bloomington, &c.

10:45 A. M. PACIFIC FAST LINE, (Except Sunday,) stopping at Riverside, Hinsdale, Aurora, Leland, Mendota, Princeton, Buda, Kewanee, Galva, Galesburg, and all stations West and South of Galesburg.
☞ ELEGANT DAY COACHES and PULLMAN PALACE DRAWING ROOM CARS are attached to this train daily from Chicago

TO COUNCIL BLUFFS & OMAHA WITHOUT CHANGE!

9.00 P. M. PACIFIC NIGHT EXPRESS, (Daily, except Saturday,) for Burlington, Ottumwa, DesMoines, Nebraska City, Council Bluffs, Omaha, and all points West. **Pullman Drawing Room Sleeping Car** attached to this Train daily from **Chicago to Burlington,** and Elegant Day Coaches, from **Chicago to Council Bluffs and Omaha, without change!** This is the Route between

CHICAGO, COUNCIL BLUFFS & OMAHA,

—RUNNING THE CELEBRATED—

Pullman Palace Dining Cars!

49 MILES THE SHORTEST ROUTE BETWEEN

Chicago & Keokuk,

And the Only Route Without Ferrying the Mississippi River!

QUINCY, ST. JOSEPH, LEAVENW'TH & KANSAS CITY LINE.

7.40 A. M. MAIL AND EXPRESS (Except Sunday,) stopping at all stations between Chicago and Galesburg; making close connections at Mendota with Illinois Central for Amboy, Dixon, Freeport, Dunleith, Dubuque, La Salle, El Paso, Bloomington, &c.

10:45 A. M. PACIFIC EXPRESS, (Daily, except Sunday,) with ELEGANT DAY COACHES and PULLMAN'S PALACE SLEEPING CARS attached, running through from Chicago to KANSAS CITY, **Without Change!**

9:00 P. M. PACIFIC NIGHT EXPRESS, (Daily,) with **Pullman Palace Drawing Room Sleeping Car** attached running through from Chicago to QUINCY,

Kansas City, Lawrence, Topeka and Denver,
☞ WITHOUT CHANGE! ☜

64 MILES THE SHORTEST AND ONLY ROUTE BETWEEN

Chicago and Kansas City!

WITHOUT CHANGE OF CARS OR FERRY.

115 MILES The Shortest Route bet. Chicago & St. Joseph.

THE SHORTEST, BEST AND QUICKEST ROUTE BETWEEN CHICAGO AND

Atchison, Weston, Leavenworth, Lawrence,

AND ALL POINTS ON THE KANSAS PACIFIC R'Y.

Local Trains Leave { RIVERSIDE & HINSDALE ACCOMMODATION.7:00 A. M. 1:30 & 6:15 P.M
GALESBURG PASSENGER.....3:00 P. M.
MENDOTA PASSENGER.....4:15 P. M.
AURORA PASSENGER.....5:30 P. M.

Ask for Tickets via Chicago, Burlington & Quincy Railroad, which can be obtained at all principal offices of connecting roads, at Company's office, 63 Clark Street, and at Great Central Depot, Chicago at as low rates as by any other route.

ROB'T HARRIS, Gen'l Superintendent, CHICAGO.
SAM'L POWELL, Gen'l Ticket Agent, CHICAGO.
E. A. PARKER, Gen. West. Pass. Agt., CHICAGO.

THE GREAT THROUGH PASSENGER ROUTE TO KANSAS

IS VIA THE OLD RELIABLE

HANNIBAL & ST. JOSEPH
SHORT LINE.

Crossing the Mississippi at Quincy and the Missouri at Kansas City on New Iron Bridges; running Three Daily Express Trains, Through Cars and Pullman Sleeping Palaces from Chicago & Quincy to St. Joseph & Kansas City.

The Advantages gained by this Line over any other Route from Chicago, are:

115 MILES THE SHORTEST!

To St. Joseph, Atchison, Hiawatha, Waterville, Weston, Leavenworth,

64 MILES THE SHORTEST!

To Kansas City, Fort Scott, Lawrence, Ottawa,

Garnett, Iola, Humboldt, Topeka, Burlingame, Emporia, Manhattan, Fort Riley, Junction City, Salina, Ellsworth. Hays, Sheridan, Olathe, Paola, Cherokee Neutral Lands, Baxter Springs, Santa Fe, New Mexico, and all Points on the KANSAS PACIFIC, and MISSOURI RIVER, FT. SCOTT & GULF R. R's, with which we connect at Kansas City Union Depot.

THIS BEING THE SHORTEST LINE AND QUICKEST, is consequently the cheapest; and no one that is posted thinks of taking any other Route from Chicago to reach principal points in

Missouri, Kansas, Indian Territory, or New Mexico.

DAILY OVERLAND STAGES from west end Kansas Pacific Railway, for Pueblo, Santa Fe, Denver, and points in Colorado and New Mexico.

THIS is also a most desirable Route, via St. Joseph, to Brownsville, Nebraska City, Council Bluffs, and Omaha, connecting with the Union Pacific Railroad for Cheyenne, Denver, Salt Lake, Sacramento, San Francisco, and the Pacific coast.

Through Tickets for Sale at all Ticket Offices. Baggage Checked Through, and Omnibus Transfers and Ferriage avoided.

P. B. GROAT, Gen. Ticket Agent. HANNIBAL, Mo
GEO. H. NETTLETON, Gen. Supt. HANNIBAL, Mo.

Old, Reliable, Air-Line Route!

CHICAGO, ALTON & ST. LOUIS R. R.

SHORTEST, QUICKEST AND ONLY DIRECT ROAD TO

Bloomington, Springfield, Jacksonville, Alton

— AND —

ST. LOUIS!

WITHOUT CHANGE OF CARS.

THE ONLY ROAD MAKING IMMEDIATE CONNECTIONS AT ST. LOUIS WITH MORNING AND EVENING TRAINS

—FOR—

ATCHISON, LEAVENWORTH, KANSAS CITY,

Lawrence, Topeka, Memphis, New Orleans,

And All Points South and Southwest.

☞ TRAINS leave CHICAGO from the West-side Union Depot, near Madison Street Bridge. ☜

	Depart.	Arrive.
EXPRESS MAIL	*9:15 A. M.	*8:05 P. M.
JOLIET ACCOMMODATION	*4:00 P. M.	*9:40 A. M.
NIGHT EXPRESS	†5:30 "	*12:50 P. M.
LIGHTNING EXPRESS	‡9:00 "	*7:30 A. M.

*Sundays excepted.
†Daily; Saturdays it runs to Bloomington only.
‡Saturdays and Sundays excepted. Monday mornings this train runs from Bloomington to St. Louis.

This is the ONLY LINE Between CHICAGO & ST. LOUIS RUNNING

Pullman's Palace Sleeping and Celebrated Dining Cars!

BAGGAGE CHECKED THROUGH.

Through Tickets can be had at the Company's office, No. 55 Dearborn street, Chicago, or at the Depot, corner of West Madison and Canal streets, and at all principal Ticket Offices in the United States and Canada. Rates of Fare and Freights as low as by any other Route.

A. NEWMAN, Gen. Pass. Agent. **J. C. McMULLIN, Gen. Supt.**

North Missouri R. R.

PASSENGERS FOR

KANSAS AND THE WEST,

ARE REMINDED THAT

THE NORTH MISSOURI R. R.

— IS —

11 MILES SHORTER than any other Route!

BETWEEN

St. Louis and Kansas City.

15 Miles Shorter between ST. LOUIS and LEAVENWORTH

— AND —

50 MILES SHORTER TO ST. JOSEPH!

THAN ANY OTHER LINE OUT OF ST. LOUIS.

☞ **Three Through Express Trains Daily!** ☜

Pullman's Celebrated Palace Sleeping Cars on all Night Trains!

☞ **FOR TICKETS,** apply at all Railroad Ticket Offices, and see that you get your Tickets via St. Louis and North Missouri Railroad.

JAMES CHARLTON, Gen. Pass. and Ticket Agent, St. Louis.
W. R. ARTHUR, General Superintendent, St. Louis.

Pacific Railroad of Missouri.

THE MOST DIRECT AND RELIABLE ROUTE FROM ST. LOUIS THROUGH TO

KANSAS CITY, LEAVENWORTH & ATCHISON,

☞ WITHOUT CHANGE OF CARS! ☜

Close Connections at KANSAS CITY with Missouri Valley, Missouri River, Ft. Scott & Gulf, and Kansas Pacific R'ys, for Weston, St. Joseph, Junction City, Fort Scott, Lawrence, Topeka, Sheridan, Denver, Fort Union, Santa Fe, and

ALL POINTS WEST!

☞ At SEDALIA, WARRENSBURG and PLEASANT HILL, with Stage Lines for Warsaw, Quincy, Bolivar, Springfield, Clinton, Osceola, Lamar, Carthage, Granby, Neosho, Baxter Springs, Fort Gibson, Fort Smith, Van Buren, Fayetteville, Bentonville.

PALACE SLEEPING CARS on all NIGHT TRAINS.

Baggage Checked Through Free!

THROUGH TICKETS for sale at all the Principal Railroad Offices in the United States and Canadas. **Be Sure and Get your Tickets over the PACIFIC R. R. OF MISSOURI.**

W. B. HALE, Gen. Pass. and Ticket Agt.
THOS. McKISSOCK, General Superintendent

61 Miles the Shortest Line!

— FROM —

CHICAGO TO NEW YORK.

Pitts., Ft. Wayne & Chicago

— AND —

PENNSYLVANIA CENTRAL

IS THE ONLY ROUTE

Running its Entire Trains THROUGH to Philadelphia and New York, and the only Route running Three Daily Lines of Pullman Day and Sleeping Palaces, from Chicago to

PITTSBURGH, HARRISBURG,

PHILADELPHIA & NEW YORK,

☞ WITHOUT CHANGE! ☜

WITH BUT ONE CHANGE TO

BALTIMORE, PROVIDENCE, NEW HAVEN, HARTFORD, SPRINGFIELD, WORCESTER & BOSTON!

AND THE MOST DIRECT ROUTE TO WASHINGTON.

☞ Trains Leave WEST SIDE UNION DEPOT, corner West Madison and Canal Streets, as follows:

	Mail.	Fast Express.	Pacific Exp.	Night Exp.
Leave—CHICAGO	5.30 A. M.	9.00 A. M.	5.15 P. M.	9.00 P. M.
Arrive—PLYMOUTH	9.50 "	12.03 P. M.	8.45 "	12.35 A. M.
" FORT WAYNE	12.30 P. M.	2.05 "	11.15 "	3.10 "
" LIMA	3.24 "	4.06 "	1.23 A. M.	5.40 "
" FOREST	4.43 "	5.08 "	2.43 "	7.07 "
" CRESTLINE	6.20 "	6.30 "	4.20 "	8.55 "
Leave—CRESTLINE	6.00 A. M.	6.50 "	4.30 "	9.35 "
Arrive—MANSFIELD	6.40 "	7.17 "	5.00 "	10.05 "
" ORRVILLE	9.15 "	9.05 "	6.54 "	11.55 "
" ALLIANCE	11.10 "	10.40 "	8.30 "	1.30 P. M.
" PITTSBURGH	3.45 P. M.	1.55 A. M.	12.10 P. M.	4.40 "
" CRESSON	11.57 "	5.44 "	4.48 "	10.00 "
" ALTOONA	12.48 A. M.	6.35 "	5.55 "	2.40 A. M.
" HARRISBURG	5.30 "	11.25 "	10.45 "	2.50 "
" PHILADELPHIA	6.50 "	3.15 "	3.00 "	6.50 "
" NEW YORK, VIA PHILADELPHIA	10.30 "	6.30 "	6.41 "	10.30 "
" NEW YORK, VIA ALLENTOWN	10.30 "	6.30 "	.....	10.30 "
" BALTIMORE	9.15 P. M.	3.05 "	2.30 A. M.	9.15 P. M.
" WASHINGTON	1.00 "	5.15 "	5.45 "	1.00 "
" BOSTON	9.00 "	5.50 A. M.	6.00 "	9.00 "

Boston and New England Passengers will find this Route especially Desirable, as it gives them an opportunity of Seeing the FINEST VIEWS AMONG THE ALLEGHANY MOUNTAINS,

Besides Visiting PITTSBURGH, PHILADELPHIA and NEW YORK, without extra cost!

☞ All New England Passengers holding Through Tickets will be Transferred, with their Baggage, to Rail and Boat Connections in NEW YORK, **Without Charge!**

THROUGH TICKETS for sale at the Company's Offices, at 65 Clark St.; 52 Clark St.; cor. Randolph and LaSalle Sts.; and at Depot, Chicago. Also at Principal Ticket Offices in the West.

CLOSE CONNECTIONS Made at LIMA for all Points on the Dayton & Michigan and the Cincinnati, Hamilton & Dayton Railways, and at CRESTLINE for Cleveland and Columbus.

Express Trains are Equipped with WESTINGHOUSE AIR BRAKES,

The Most Perfect Protection Against Accidents in the World!

F. R. MYERS, Gen. Pass. & Tkt Agt. P. F.W. & C. R'y Chicago. | **W. C. CLELAND,** Gen. Western Pass. Agt. P. F. W. & C. R'y, Chicago.

T. L. KIMBALL, Gen. Western Pass. Agt. Penn. Cen. R. R. Chicago.

Broad Gauge! Double Track!

ERIE RAILWAY.

4 EXPRESS TRAINS DAILY!

From Cleveland, Dunkirk and Buffalo, 625 Miles, to New York, WITHOUT CHANGE of Coaches!

☞ The Trains of this Railway are run in DIRECT CONNECTION WITH ALL WESTERN AND SOUTHERN LINES, for

Elmira, Williamsport, Oswego, Great Bend, Scranton, Newburgh,

NEW YORK, ALBANY, BOSTON, PROVIDENCE,

AND PRINCIPAL NEW ENGLAND CITIES.

New and Improved DRAWING ROOM COACHES are attached to the DAY EXPRESS Running THROUGH TO NEW YORK.

☞ **SLEEPING COACHES,** Combining all Modern Improvements, with perfect Ventilation and the peculiar arrangements for the comfort of Passengers incident to the **BROAD GAUGE,** accompany all night trains to New York.

CONNECTIONS CERTAIN! as Trains on this Railway will, when necessary, **wait from one to two hours for Western trains.**

All Trains of Saturday run directly Through to New York.

☞ **Ask for Tickets via Erie Railway,** which can be procured at **66 Clark Street,** Chicago, and at all Principal Ticket offices in the West and Southwest.

L. D. RUCKER, Gen'l Superintendent, New York. | **A. J. DAY,** Western Passenger Agent, Chicago. | **WM. R. BARR,** Gen'l Passenger Agent, New York.

Pan-Handle

— AND —

Penn'a Central Route East!

☞ SHORTEST AND QUICKEST ROUTE, VIA COLUMBUS, TO ☜

PITTSBURGH, BALTIMORE, PHILADELPHIA & NEW YORK

On and after Sunday, NOVEMBER 20th, 1870, Trains for the East will run as follows:

[DEPOT CORNER CANAL AND KINZIE STS., WEST SIDE.]

7:40 A. M. DAY EXPRESS.

[SUNDAYS EXCEPTED.] Via Richmond. Arriving at

COLUMBUS....	3:00 A. M.	HARRISBURG..	10:35 P. M.	NEW YORK....	6:40 A. M.
PITTSBURGH..	12:15 M.	PHILADELPHIA	3:10 A. M.	BALTIMORE. ..	2:30 A. M.
WASHINGTON..	5:45 A. M.	BOSTON.....	5:05 P. M.		

7:10 P. M. NIGHT EXPRESS.

[SUNDAYS EXCEPTED.] Arriving at:

COLUMBUS.. ..	11:15 A. M.	HARRISBURG.	5:20 A. M.	NEW YORK...	11:40 A. M.
PITTSBURGH..	7:25 P. M.	PHILADELPHIA.	9.50 A. M.	BALTIMORE...	9:30 A. M.
WASHINGTON.	1:10 P. M.	BOSTON.....	11:50 P. M.		

Palace Day and Sleeping Cars

Run Through to COLUMBUS, and from Columbus to NEW YORK, WITHOUT CHANGE!

ONLY ONE CHANGE TO NEW YORK, PHILADELPHIA, OR BALTIMORE!

CINCINNATI & LOUISVILLE AIR LINE SOUTH.

35 Miles the Shortest Route to Cincinnati,
18 Miles the Shortest Route to Indianapolis and Louisville.

3 Hours the Quickest Route to Cincinnati!

THE SHORTEST AND BEST ROUTE TO

Columbus, Chillicothe, Hamilton, Dayton, Wheeling, Zanesville, Parkersburg, Marietta, Evansville, Lexington, Terre Haute, Nashville,

ALL POINTS IN CENTRAL & SOUTHERN OHIO, & INDIANA, KENTUCKY & VIRGINIA.

— QUICK, DIRECT AND ONLY ALL RAIL ROUTE TO —

New Orleans, Memphis, Mobile, Vicksburg, Charleston, Savannah,

AND ALL POINTS SOUTH.

Cincinnati, Indianapolis and Louisville Trains run as follows:

THROUGH WITHOUT CHANGE OF CARS!

7.40 A. M. (Sundays excepted) Arriving at

LOGANSPORT	1:15 P. M.
KOKOMO	2:33 P. M.
CINCINNATI	10:10 P. M.
INDIANAPOLIS	5:00 P. M.
LOUISVILLE	11:30 P. M.

8.05 P. M. (Saturdays excepted.) Arriving at

LOGANSPORT	1:15 A. M.
KOKOMO	2:31 A. M.
CINCINNATI	9:35 A. M.
INDIANAPOLIS	5:40 A. M.
LOUISVILLE	3:50 P. M

Lansing Accommodation: Leaves 3:40 P. M. Arrives 10:55 A. M.

PULLMAN'S PALACE SLEEPING CARS!

Accompany all Night Trains between Chicago and Cincinnati or Indianapolis.

☞ Ask for Tickets **via COLUMBUS** for the East, and **via "The AIR LINE"** for Cincinnati, Indianapolis, Louisville and points South. Tickets for sale and Sleeping Car Berths secured at **95 RANDOLPH STREET, CHICAGO,** and at Principal Ticket Offices in the West and Northwest.

WM. L. O'BRIEN, Gen. Pass. and Ticket Agent, Columbus. | **I. S. HODSDON** Northwestern Pass. Agt. Chicago.

D. W. CALDWELL Gen Supt. Columbus.

The Great Favorite Route for Missouri, Nebraska and Iowa.

KANSAS CITY, ST. JOSEPH

— AND —

COUNCIL BLUFFS

☞ THROUGH LINE! ☜

3 EXPRESS PASSENGER TRAINS Leave Union Depot Daily, on the arrival of Eastern Southern and Western Trains, crossing the Missouri River on the New Iron Bridge at KANSAS CITY, passing the cities of

LEAVENWORTH, ATCHISON, SAINT JOSEPH,

— AND —

NEBRASKA CITY.

Connecting at COUNCIL BLUFFS with Iowa Lines for all prominent points in Iowa, and making DIRECT CONNECTION at **OMAHA** with the Great **Union Pacific Railroad,** for

CHEYENNE, DENVER, SALT LAKE, SACRAMENTO, SAN FRANCISCO

And the Pacific Coast.

Pullman's Palace Sleeping Cars!

ON ALL NIGHT TRAINS.

☞ Ask for Tickets via the People's Favorite Route, **Kansas City, St. Joseph & Council Bluffs Railroad Line.**

A. L. HOPKINS, Gen. Superintendent ST. JOSEPH, Mo. | **A. C. DAWES,** Gen. Passenger Agent, ST. JOSEPH, Mo

LAKE SHORE
— AND —
MICHIGAN SOUTHERN R.W.

THE GREAT THROUGH LINE BETWEEN

CHICAGO, BUFFALO & NEW YORK,

WITHOUT CHANGE!

AND THE ONLY RAILWAY

RUNNING PALACE COACHES THROUGH!

— BETWEEN —

CHICAGO & NEW YORK, via BUFFALO

☞ WITHOUT TRANSFER OF PASSENGERS! ☜

All Trains Stop at Twenty-Second Street to Take and Leave Passengers. Baggage Checked at that Station for all Points East.

4 EXPRESS TRAINS DAILY, [Sundays Excepted,] Leave Chicago from the New Depot, on Van Buren St., at the head of L a Salle Street, as follow

5:30 A. M. MAIL TRAIN. VIA OLD ROAD AND AIR LINE. SUNDAYS EXCEPTED.

Leaves 22d Street 7:45 A. M. Stops at all Stations. **Arrives**—Cleveland, 9:35 P. M.

9:00 A. M. SPECIAL NEW YORK EXPRESS, VIA AIR LINE. SUNDAYS EXCEPTED.

Leaves—Twenty-Second Street, **9:15 A. M. Arrives**—Elkhart, 12:45 P. M.; Cleveland 9:45 P. M.; Buffalo, 4:10 A. M.; New York, 7:00 P. M.; (Chicago Time) Boston, 11:45 P. M.

This Train has PALACE SLEEPING COACH Attached, Running

THROUGH TO ROCHESTER, WITHOUT CHANGE!

IN DIRECT CONNECTION WITH

Wagner's Celebrated Drawing-Room Coaches on N. Y. Central R. R.

Only Thirty-Three Hours, Chicago to New York!

5:15 P. M. ATLANTIC EXPRESS (Daily), VIA OLD ROAD.

Leaves—Twenty-Second Street **5:30 P. M. Arrives**—Laporte, 8:10 P. M. (Stops 20 minutes or Supper); arrives at Toledo, 2:50 A. M.; Cleveland, 7:25 A. M. (20 minutes for Breakfast); arrives at Buffalo, 1:50 P. M.; Rochester, 5:10 P. M. (20 minutes for Supper); connects with **Sleeping Coach running Through from Rochester to Boston Without Change,** making but **One Change between Chicago and Boston.**

NEW AND ELEGANT SLEEPING COACH Attached to this Train, Running THROUGH from CHICAGO TO NEW YORK WITHOUT CHANGE! Arrives at NEW YORK, 7:15 A. M.

9:00 P M. NIGHT EXPRESS VIA AIR LINE. (DAILY EXCEPT SAT. & SUN.)

Leaves—Twenty-Second Street, **9:15 P. M. Arrives**—Toledo, 6:15 A. M. (20 minutes for Breakfast); arrives at Cleveland, 10:50 A. M.; Buffalo, 5:50 P. M.; New York, 12:00 M.; Boston, 3:50 P. M.

KALAMAZOO DIVISION.

Leave Chicago 9:00 A. M. Arrive at Kalamazoo 4:10 P. M.; Grand Rapids, 7:10 P. M.

Leave Chicago 9:00 P. M. Arrive at Kalamazoo 7:25 A. M.; Grand Rapids, 10:15 A. M.

☞ There being no heavy grades to overcome, or mountains to cross, the road bed and track being the smoothest and most perfect of any railway in the United States, this Company run their trains at a high rate of speed with perfect safety.

☞ Travelers who wish to SAVE TIME and make SURE CONNECTIONS, purchase Tickets via

LAKE SHORE & MICHIGAN SOUTHERN R'Y.

THE ONLY LINE RUNNING THROUGH BETWEEN CHICAGO AND BUFFALO, WITHOUT TRANSFER, and in Direct Connection with NEW YORK CENTRAL RAILROAD and ERIE RAILWAY.

General Ticket Office for Chicago, No. 56 Clark Street.

CHAS. F. HATCH,
General Superintendent, CLEVELAND, OHIO

F. E. MORSE,
General Western Passenger Agent, CHICAGO.

ILLINOIS CENTRAL RAILROAD.

PASSENGER TRAINS LEAVE CHICAGO FROM THE GREAT CENTRAL DEPOT, FOOT OF LAKE ST.

ST. LOUIS AND CHICAGO
THROUGH LINE.

No Change of Cars from Chicago to St. Louis.

9:20 A. M. DAY EXPRESS Sundays Ex. Arriving in ST. LOUIS at 10:30 P. M.

8:15 P. M. FAST LINE. Saturdays Excepted. Arriving at ST. LOUIS at 8:00 A. M.

AT ST. LOUIS, Direct Connections are Made FOR

Jefferson City, Sedalia, Pleasant Hill, Macon, Kansas City,

LEAVENWORTH, ST. JOSEPH & ATCHISON,

—Connecting at KANSAS CITY for—

LAWRENCE, TOPEKA, JUNCTION CITY, SALINA, SHERIDAN,

Denver and San Francisco!

CAIRO, MEMPHIS AND NEW ORLEANS LINE.

No Change of Cars from Chicago to Cairo.

9:20 A. M. CAIRO MAIL, Sundays Excepted. Arriving at **Cairo** 2:05 A. M., **Memphis** 12:45 P. M., **Mobile** 9:25 A. M. **Vicksburg** 9:25 A. M., **New Orleans** 11:05 A. M.

8:15 P. M. CAIRO EXPRESS, Except Saturdays. Arriving at **Cairo** 12:24 P. M., **Memphis** 4:15 A. M., **Little Rock** 7:00 P. M., **Vicksburg** 8:10 P. M., **New Orleans** 1:30 A. M.

4:50 P. M. CHAMPAIGN PASSENGER, Arriving at **Champaign** at 10:45 P. M.

☞ THIS IS THE ONLY DIRECT ROUTE TO

Humboldt, Corinth, Grand Junction, Little Rock, Hot Springs, Selma, Canton, Grenada, Columbus, Meridian, Enterprise,

MEMPHIS, VICKSBURG, NEW ORLEANS & MOBILE.

At NEW ORLEANS, connections are made for

GALVESTON, INDIANOLA,

And all Parts of Texas.

☞ **NOTICE.**—This Route is from **100 to 150 MILES SHORTER,** and from **12 to 24 HOURS QUICKER** than any other.

THIS IS ALSO THE ONLY DIRECT ROUTE TO

DECATUR, TERRE HAUTE, VINCENNES & EVANSVILLE.

Peoria and Keokuk Line.

9:20 A. M. KEOKUK PASSENGER, Sun. Excepted. Arriving at **Chenoa** 3:20 P. M., **El Paso** 4:08 P. M., **Peoria** 5:42 P. M., **Canton** 7:15 P. M., **Bushnell** 8:57 P. M., **Keokuk** 11:15 P. M., **Warsaw** 11:40 A. M.

Elegant Drawing Room Sleeping Cars

ATTACHED TO ALL NIGHT TRAINS.

Spacious and Fine Saloon Cars!

WITH ALL MODERN IMPROVEMENTS, RUN UPON ALL TRAINS.

BAGGAGE CHECKED THROUGH TO ALL IMPORTANT POINTS.

☞ For Through Tickets, Sleeping Car Berths, Baggage Checks, and information, apply at the office of the Company in the Great Central Depot, foot of Lake St.

Hyde Park and Oakwoods Train.

	LEAVE.	ARRIVE.		LEAVE.	ARRIVE.
HYDE PARK TRAIN,...	*6:30 A. M.	*7.45 A. M.	HYDE PARK TRAIN,....	*3:00 P. M.	*3:15 P. M
HYDE PARK TRAIN...	*8:00 A. M.	*9.20 A. M.	HYDE PARK TRAIN,....	*6:10 P. M.	*7:35 P. M
HYDE PARK TRAIN,..	*12:10 P. M.	*1:45 P. M.			

* Sundays Excepted.

W. P. JOHNSON, Gen. Pass. Agent. M. HUGHITT, Gen. Supt.

1870. Great Central Route! 1870.

SPEED! COMFORT! SAFETY!

MICHIGAN CENTRAL and GREAT WESTERN RAILWAYS!

The Great Central Route, via Niagara Falls, to

NEW YORK AND NEW ENGLAND.

Pullman's Magnificent Palace Drawing-Room Cars,

— FROM —

CHICAGO TO NEW YORK CITY, WITHOUT CHANGE.

4 PASSENGER TRAINS LEAVE CHICAGO, DAILY EXCEPT SUNDAY.
(DEPOT, FOOT OF LAKE STREET,) as Follows:

5:40 A. M. (SUNDAYS EXCEPTED.) MAIL TRAIN. Stops at all Stations.
Arrives DETROIT at 6:30 P. M.

9:00 A. M. (SUNDAYS EXCEPTED.) SPECIAL NEW YORK & BOSTON EXP.
Arrives at Michigan City 11:10 A. M.; Niles 12:40, [Dinner], Kalamazoo 2:15 P. M.; Battle Creek 3:00, Marshall 3:24, Jackson 4:30, Detroit 6:55; London 12:05, A. M. Hamilton 2:35 A. M.; Toronto 10:00, Suspension Bridge 4:40, Rochester 7:15 A. M.; Albany, 2:25 P. M.; NEW YORK, 7:00, BOSTON, 11:45 P. M. ☞ This train connects at ROCHESTER (7:15 A. M.) with

Wagner's Magnificent Palace Drawing-Room Cars!

☞ RUNNING THROUGH TO NEW YORK, WITHOUT CHANGE! ☜

5:15 P. M. (DAILY.) ATLANTIC EXPRESS.
Arrives at Michigan City, 7:22 P. M.; Niles 8:5) P. M. [Supper]; Kalamazoo, 10:30 P. M.; Jackson, 1:05 A. M.; Detroit 3:45, London, 8:35, [Breakfast]; Hamilton 11:40, Suspension Bridge 2:35 P. M.; Rochester 5:10 P. M.; Albany, 1:50 A. M.; NEW YORK, 7:15 A. M.; BOSTON, 11:00 A. M. A MAGNIFICENT DRAWING-ROOM SLEEPING CAR is attached to this train daily, FROM CHICAGO TO NEW YORK CITY. The celebrated

☞ **Hotel Drawing-Room Car is also attached to this Train from Chicago to Rochester!** ☜

☞ These, together with **ELEGANT DAY CARS TO SUSPENSION BRIDGE,** make this Train the favorite Train for all points East.

SPECIAL NOTICE.—Boston and New England Passengers will please notice that this Train now makes direct connection through. A SLEEPING CAR is attached at Rochester at 5.20 P. M., running through to Springfield, Mass., thus avoiding transfer at Albany. Breakfast at Springfield. This Train reaches Springfield early enough second morning to **Connect with all Trains** up and down the Connecticut.

9:00 P. M. (SAT. & SUN. EXCEPTED). NIGHT EXPRESS.
Arrives at Michigan City, 11:10 P. M.; Niles, 12:28 A. M.; Kalamazoo, 2:10; Marshall, 3:25; Jackson, 4:45; Grand Trunk Junction, 7:30; Detroit, 7:45; London, 1:45 P. M.; Hamilton, 4:35; Toronto, 9:35; Niagara Falls, 6:25; Buffalo, 7:15 P. M.; Rochester, 9:05; Syracuse, 12:25 A. M.; Rome, 1:55; Utica, 2:35; Albany, 6:30 A. M.; NEW YORK, 12:00 M.; BOSTON, 3:50 P. M.

PULLMAN'S PALACE SLEEPING CARS ARE ATTACHED TO THIS TRAIN FROM CHICAGO TO DETROIT,
And from Suspension Bridge to New York.

WE INVITE THE ATTENTION OF THE TRAVELER to the SPLENDID EQUIPMENTS of this FIRST-CLASS LINE TO THE EAST!

☞ FOR THROUGH TICKETS, and any and all information, Sleeping Car accommodations, &c., apply at General Office in Tremont House Block, at office in Great Central Depot; also at No. 60 Clark street, under Sherman House; at Grand Trunk Railway Office, 48 Clark street, or at New York Central Railroad Office, No. 53 Clark street, and at office under Briggs House.

H. E. SARGENT, Gen. Supt. M. C. R. R. W. K. MUIR, Gen. Supt. Gt. Western R. W. HENRY C. WENTWORTH, Gen. Pass. Agt.

CHICAGO, INDIANAPOLIS & LOUISVILLE

THROUGH LINE!

—VIA—

MICHIGAN CENTRAL RAILROAD.

THE ONLY ROUTE TO

TO LOUISVILLE, WITHOUT CHANGE OF CARS.

TWO EXPRESS TRAINS Leave Chicago Depot, Foot of Lake as Follows:

9:00 A. M. (EXCEPT SUNDAY.) MORNING EXPRESS
Arriving at LaFayette, 2:25 P. M.; Indianapolis, 6:00 P. M; Louisville, 11:30 P. M.

4:30 P. M. (EXCEPT SATURDAY.) AFTERNOON EXPRESS
Arriving at Michigan City 6:30 P. M. [Supper]; LaFayette, 11:30 P. M. Indianapolis, 2:15 A. M.; Louisville, 7:00 A. M.; Nashville, 4.00 P. M.

A GOOD SLEEPING CAR is Attached to this Train Every Night,
And goes from Chicago to Louisville WITHOUT CHANGE!

☞ **SPECIAL NOTICE.**—This Train stops at Michigan City for Supper, and waits at that point for Michigan Central Atlantic Express East, leaving Chicago at 4:45 p. m. Passengers going South, and wishing as much time in Chicago as possible, can take the 4:45 p. m. Michigan Central Atlantic Express, and connect without fail at Michigan City, with above Through Louisville Express.

☞ **THE GREAT BRIDGE ACROSS THE OHIO** at Louisville being completed, passengers are relieved of the omnibus transfer.

FOR THROUGH TICKETS, via this line, apply at offices of connecting lines and at all Ticket offices in Chicago.

HENRY C. WENTWORTH, Gen. Pass. Agent.

Michigan Central R. R.

LOCAL CONNECTIONS:

Chicago & Michigan Lake Shore Railroad.

Open from New Buffalo to St. Joseph, Mich.

5:00 A. M. AND **4:30** P. M. **Trains from Chicago Connect at New Buffalo.**

Kalamazoo, Allegan & Grand Rapids R. R.

Open to Grand Rapids.

11:30 A. M. AND **9:00** P. M. **Trains from Chicago Connect at Kalamazoo**

Peninsular Railroad of Michigan.

Open to Charlotte.

5:00 A. M. AND **9:00** P. M. **Trains from Chicago Connect at Battle Creek.**

Jackson, Lansing & Saginaw Railroad.

Open to Bay City, Mich. Passing through Lansing and Saginaw.

5:00 A. M. AND **9:00** P. M. **Trains from Chicago Connect at Jackson.**

GRAND TRUNK RAILWAY.

All Michigan Central Trains Connect at Grand Trunk Junction

— FOR —

SARNIA, TORONTO, MONTREAL,

PORTLAND, BOSTON, BUFFALO, OGDENSBURG

AND ALL POINTS EAST.

H. E. SARGENT, General Superintendent.

JACOB R. SHIPHERD & CO.,

155 and 157 LaSalle Street,

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Make Advances; Complete Unfinished Roads, etc., etc.

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All descriptions of Files Manufactured and Recut. Also, dealers in *Best English Cast Tool Steel*. Orders solicited and satisfaction guaranteed. JOHN PARKIN, Prop'r.

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TUBE WORKS & IRON COMPANY.

PHILADELPHIA, PA.

Manufacture Plain and Galvanized WROUGHT IRON PIPE and Sundries for Gas and Steam Fitters, Plumbers, Machinists, Railing Makers, Oil Refiners, &c.

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Harrisburg, Pennsylvania,

MANUFACTURE

Passenger, Mail, Baggage, Box, Gondola, Coal,

AND ALL OTHER KINDS OF

RAILROAD CARS!

Railroad Car Wheels & Castings, Bridge & Rolling Mill Castings, Bridge Rods, Bolts,

—AND—

RAILROAD FORGINGS!

W. T. HILDRUP, *Superintendent.*
WILLIAM COLDER, *President.*

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Foundry and Machine Works!

(Branch of Harrisburg Car Mfg Co.,)

Harrisburg, - - Pennsylvania.

MANUFACTURERS OF

MACHINISTS' TOOLS!

— SUCH AS —

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W. T. HILDRUP, *Treasurer.*

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Clarke, Reeves & Co.,

Successors to Kellogg, Clarke & Co.,

Engineers & Iron Bridge Builders,

OF PHŒNIXVILLE, PA.,

Will henceforth have their Principal Business Office at 410 Walnut St., Philadelphia, to which all correspondence should be addressed. Circulars, plans and prices sent on application.

IRON BRIDGES, PIVOT BRIDGES

— AND —

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F. E. Canda,

BRIDGE BUILDER

—AND—

GENERAL CONTRACTOR.

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